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(54) Title: COMPOSITIONS AND METHODS FOR THERAPY AND DIAGNOSIS OF BREAST CANCER

(57) Abstract: Compositions and methods for the therapy and diagnosis of cancer, such as breast cancer, are disclosed. Compositions may comprise one or more breast tumor proteins, immunogenic portions thereof, or polynucleotides that encode such portions. Alternatively, a therapeutic composition may comprise an antigen presenting cell that expresses a breast tumor protein, or a T cell that is specific for cells expressing such a protein. Such compositions may be used, for example, for the prevention and treatment of diseases such as breast cancer. Diagnostic methods based on detecting a breast tumor protein, or mRNA encoding such a protein, in a sample are also provided.

COMPOSITIONS AND METHODS FOR THERAPY AND DIAGNOSIS OF BREAST CANCER

TECHNICAL FIELD

The present invention relates generally to therapy and diagnosis of
5 cancer, such as breast cancer. The invention is more specifically related to polypeptides
comprising at least a portion of a breast tumor protein, and to polynucleotides encoding
such polypeptides. Such polypeptides and polynucleotides may be used in vaccines and
pharmaceutical compositions for prevention and treatment of breast cancer, and for the
diagnosis and monitoring of such cancers.

10 BACKGROUND OF THE INVENTION

Breast cancer is a significant health problem for women in the United
States and throughout the world. Although advances have been made in detection and
treatment of the disease, breast cancer remains the second leading cause of cancer-
related deaths in women, affecting more than 180,000 women in the United States each
15 year. For women in North America, the life-time odds of getting breast cancer are now
one in eight.

No vaccine or other universally successful method for the prevention or
treatment of breast cancer is currently available. Management of the disease currently
relies on a combination of early diagnosis (through routine breast screening procedures)
20 and aggressive treatment, which may include one or more of a variety of treatments
such as surgery, radiotherapy, chemotherapy and hormone therapy. The course of
treatment for a particular breast cancer is often selected based on a variety of prognostic
parameters, including an analysis of specific tumor markers. *See, e.g.,* Porter-Jordan
and Lippman, *Breast Cancer* 8:73-100 (1994). However, the use of established markers
25 often leads to a result that is difficult to interpret, and the high mortality observed in
breast cancer patients indicates that improvements are needed in the treatment,
diagnosis and prevention of the disease.

Accordingly, there is a need in the art for improved methods for therapy and diagnosis of breast cancer. The present invention fulfills these needs and further provides other related advantages.

SUMMARY OF THE INVENTION

5 Briefly stated, the present invention provides compositions and methods for the diagnosis and therapy of cancer, such as breast cancer. In one aspect, the present invention provides polypeptides comprising at least a portion of a breast tumor protein, or a variant thereof. Certain portions and other variants are immunogenic, such that the ability of the variant to react with antigen-specific antisera is not substantially
10 diminished. Within certain embodiments, the polypeptide comprises a sequence that is encoded by a polynucleotide sequence selected from the group consisting of: (a) sequences recited in SEQ ID NO: 1-38, 42-204, 205, 207 and 210-290; (b) variants of a sequence recited in SEQ ID NO: 1-38, 42-204, 205, 207 and 210-290; and (c) complements of a sequence of (a) or (b).

15 The present invention further provides polynucleotides that encode a polypeptide as described above, or a portion thereof (such as a portion encoding at least 15 amino acid residues of a breast tumor protein), expression vectors comprising such polynucleotides and host cells transformed or transfected with such expression vectors.

Within other aspects, the present invention provides pharmaceutical
20 compositions comprising a polypeptide or polynucleotide as described above and a physiologically acceptable carrier.

Within a related aspect of the present invention, vaccines for prophylactic or therapeutic use are provided. Such vaccines comprise a polypeptide or polynucleotide as described above and an immunostimulant.

25 The present invention further provides pharmaceutical compositions that comprise: (a) an antibody or antigen-binding fragment thereof that specifically binds to a breast tumor protein; and (b) a physiologically acceptable carrier.

Within further aspects, the present invention provides pharmaceutical compositions comprising: (a) an antigen presenting cell that expresses a polypeptide as
30 described above and (b) a pharmaceutically acceptable carrier or excipient. Antigen

presenting cells include dendritic cells, macrophages, monocytes, fibroblasts and B cells.

Within related aspects, vaccines are provided that comprise: (a) an antigen presenting cell that expresses a polypeptide as described above and (b) an immunostimulant.

The present invention further provides, in other aspects, fusion proteins that comprise at least one polypeptide as described above, as well as polynucleotides encoding such fusion proteins.

Within related aspects, pharmaceutical compositions comprising a fusion protein, or a polynucleotide encoding a fusion protein, in combination with a physiologically acceptable carrier are provided.

Vaccines are further provided, within other aspects, that comprise a fusion protein, or a polynucleotide encoding a fusion protein, in combination with an immunostimulant.

Within further aspects, the present invention provides methods for inhibiting the development of a cancer in a patient, comprising administering to a patient a pharmaceutical composition or vaccine as recited above.

The present invention further provides, within other aspects, methods for removing tumor cells from a biological sample, comprising contacting a biological sample with T cells that specifically react with a breast tumor protein, wherein the step of contacting is performed under conditions and for a time sufficient to permit the removal of cells expressing the protein from the sample.

Within related aspects, methods are provided for inhibiting the development of a cancer in a patient, comprising administering to a patient a biological sample treated as described above.

Methods are further provided, within other aspects, for stimulating and/or expanding T cells specific for a breast tumor protein, comprising contacting T cells with one or more of: (i) a polypeptide as described above; (ii) a polynucleotide encoding such a polypeptide; and/or (iii) an antigen presenting cell that expresses such a polypeptide; under conditions and for a time sufficient to permit the stimulation and/or

expansion of T cells. Isolated T cell populations comprising T cells prepared as described above are also provided.

Within further aspects, the present invention provides methods for inhibiting the development of a cancer in a patient, comprising administering to a
5 patient an effective amount of a T cell population as described above.

The present invention further provides methods for inhibiting the development of a cancer in a patient, comprising the steps of: (a) incubating CD4⁺ and/or CD8⁺ T cells isolated from a patient with one or more of: (i) a polypeptide comprising at least an immunogenic portion of a breast tumor protein; (ii) a
10 polynucleotide encoding such a polypeptide; and (iii) an antigen-presenting cell that expresses such a polypeptide; and (b) administering to the patient an effective amount of the proliferated T cells, and thereby inhibiting the development of a cancer in the patient. Proliferated cells may, but need not, be cloned prior to administration to the patient.

15 Within further aspects, the present invention provides methods for determining the presence or absence of a cancer in a patient, comprising: (a) contacting a biological sample obtained from a patient with a binding agent that binds to a polypeptide as recited above; (b) detecting in the sample an amount of polypeptide that binds to the binding agent; and (c) comparing the amount of polypeptide with a
20 predetermined cut-off value, and therefrom determining the presence or absence of a cancer in the patient. Within preferred embodiments, the binding agent is an antibody, more preferably a monoclonal antibody. The cancer may be breast cancer.

The present invention also provides, within other aspects, methods for monitoring the progression of a cancer in a patient. Such methods comprise the steps
25 of: (a) contacting a biological sample obtained from a patient at a first point in time with a binding agent that binds to a polypeptide as recited above; (b) detecting in the sample an amount of polypeptide that binds to the binding agent; (c) repeating steps (a) and (b) using a biological sample obtained from the patient at a subsequent point in time; and (d) comparing the amount of polypeptide detected in step (c) with the amount
30 detected in step (b) and therefrom monitoring the progression of the cancer in the patient.

The present invention further provides, within other aspects, methods for determining the presence or absence of a cancer in a patient, comprising the steps of: (a) contacting a biological sample obtained from a patient with an oligonucleotide that hybridizes to a polynucleotide that encodes a breast tumor protein; (b) detecting in the sample a level of a polynucleotide, preferably mRNA, that hybridizes to the oligonucleotide; and (c) comparing the level of polynucleotide that hybridizes to the oligonucleotide with a predetermined cut-off value, and therefrom determining the presence or absence of a cancer in the patient. Within certain embodiments, the amount of mRNA is detected via polymerase chain reaction using, for example, at least one oligonucleotide primer that hybridizes to a polynucleotide encoding a polypeptide as recited above, or a complement of such a polynucleotide. Within other embodiments, the amount of mRNA is detected using a hybridization technique, employing an oligonucleotide probe that hybridizes to a polynucleotide that encodes a polypeptide as recited above, or a complement of such a polynucleotide.

In related aspects, methods are provided for monitoring the progression of a cancer in a patient, comprising the steps of: (a) contacting a biological sample obtained from a patient with an oligonucleotide that hybridizes to a polynucleotide that encodes a breast tumor protein; (b) detecting in the sample an amount of a polynucleotide that hybridizes to the oligonucleotide; (c) repeating steps (a) and (b) using a biological sample obtained from the patient at a subsequent point in time; and (d) comparing the amount of polynucleotide detected in step (c) with the amount detected in step (b) and therefrom monitoring the progression of the cancer in the patient.

Within further aspects, the present invention provides antibodies, such as monoclonal antibodies, that bind to a polypeptide as described above, as well as diagnostic kits comprising such antibodies. Diagnostic kits comprising one or more oligonucleotide probes or primers as described above are also provided.

These and other aspects of the present invention will become apparent upon reference to the following detailed description. All references disclosed herein are hereby incorporated by reference in their entirety as if each was incorporated individually.

SEQUENCE IDENTIFIERS

SEQ ID NO: 1 is the determined cDNA sequence for clone 26915.
SEQ ID NO: 2 is the determined cDNA sequence for clone 26914.
SEQ ID NO: 3 is the determined cDNA sequence for clone 26673.
5 SEQ ID NO: 4 is the determined cDNA sequence for clone 26672.
SEQ ID NO: 5 is the determined cDNA sequence for clone 26671.
SEQ ID NO: 6 is the determined cDNA sequence for clone 26670.
SEQ ID NO: 7 is the determined cDNA sequence for clone 26669.
SEQ ID NO: 8 is a first determined cDNA sequence for clone 26668.
10 SEQ ID NO: 9 is a second determined cDNA sequence for clone 26668.
SEQ ID NO: 10 is the determined cDNA sequence for clone 26667.
SEQ ID NO: 11 is the determined cDNA sequence for clone 26666.
SEQ ID NO: 12 is the determined cDNA sequence for clone 26665.
SEQ ID NO: 13 is the determined cDNA sequence for clone 26664.
15 SEQ ID NO: 14 is the determined cDNA sequence for clone 26662.
SEQ ID NO: 15 is the determined cDNA sequence for clone 26661.
SEQ ID NO: 16 is the determined cDNA sequence for clone 26660.
SEQ ID NO: 17 is the determined cDNA sequence for clone 26603.
SEQ ID NO: 18 is the determined cDNA sequence for clone 26601.
20 SEQ ID NO: 19 is the determined cDNA sequence for clone 26600.
SEQ ID NO: 20 is the determined cDNA sequence for clone 26587.
SEQ ID NO: 21 is the determined cDNA sequence for clone 26586.
SEQ ID NO: 22 is the determined cDNA sequence for clone 26584.
SEQ ID NO: 23 is the determined cDNA sequence for clone 26583.
25 SEQ ID NO: 24 is the determined cDNA sequence for clone 26580.
SEQ ID NO: 25 is the determined cDNA sequence for clone 26579.
SEQ ID NO: 26 is the determined cDNA sequence for clone 26577.
SEQ ID NO: 27 is the determined cDNA sequence for clone 26575.
SEQ ID NO: 28 is the determined cDNA sequence for clone 26574.
30 SEQ ID NO: 29 is the determined cDNA sequence for clone 26573.
SEQ ID NO: 30 is the determined cDNA sequence for clone 25612.

- SEQ ID NO: 31 is the determined cDNA sequence for clone 22295.
SEQ ID NO: 32 is the determined cDNA sequence for clone 22301.
SEQ ID NO: 33 is the determined cDNA sequence for clone 22298.
SEQ ID NO: 34 is the determined cDNA sequence for clone 22297.
5 SEQ ID NO: 35 is the determined cDNA sequence for clone 22303.
SEQ ID NO: 36 is the determined cDNA sequence for a first GABA_A
receptor clone.
SEQ ID NO: 37 is the determined cDNA sequence for a second GABA_A
receptor clone.
10 SEQ ID NO: 38 is the determined cDNA sequence for a third GABA_A
receptor clone.
SEQ ID NO: 39 is the amino acid sequence encoded by SEQ ID NO: 36.
SEQ ID NO: 40 is the amino acid sequence encoded by SEQ ID NO: 37.
SEQ ID NO: 41 is the amino acid sequence encoded by SEQ ID NO: 38.
15 SEQ ID NO: 42 is the determined cDNA sequence for contig 1.
SEQ ID NO: 43 is the determined cDNA sequence for contig 2.
SEQ ID NO: 44 is the determined cDNA sequence for contig 3.
SEQ ID NO: 45 is the determined cDNA sequence for contig 4.
SEQ ID NO: 46 is the determined cDNA sequence for contig 5.
20 SEQ ID NO: 47 is the determined cDNA sequence for contig 6.
SEQ ID NO: 48 is the determined cDNA sequence for contig 7.
SEQ ID NO: 49 is the determined cDNA sequence for contig 8.
SEQ ID NO: 50 is the determined cDNA sequence for contig 9.
SEQ ID NO: 51 is the determined cDNA sequence for contig 10.
25 SEQ ID NO: 52 is the determined cDNA sequence for contig 11.
SEQ ID NO: 53 is the determined cDNA sequence for contig 12.
SEQ ID NO: 54 is the determined cDNA sequence for contig 13.
SEQ ID NO: 55 is the determined cDNA sequence for contig 14.
SEQ ID NO: 56 is the determined cDNA sequence for contig 15.
30 SEQ ID NO: 57 is the determined cDNA sequence for contig 16.
SEQ ID NO: 58 is the determined cDNA sequence for contig 17.

SEQ ID NO: 59 is the determined cDNA sequence for contig 18.
SEQ ID NO: 60 is the determined cDNA sequence for contig 19.
SEQ ID NO: 61 is the determined cDNA sequence for contig 20.
SEQ ID NO: 62 is the determined cDNA sequence for contig 21.
5 SEQ ID NO: 63 is the determined cDNA sequence for contig 22.
SEQ ID NO: 64 is the determined cDNA sequence for contig 23.
SEQ ID NO: 65 is the determined cDNA sequence for contig 24.
SEQ ID NO: 66 is the determined cDNA sequence for contig 25.
SEQ ID NO: 67 is the determined cDNA sequence for contig 26.
10 SEQ ID NO: 68 is the determined cDNA sequence for contig 27.
SEQ ID NO: 69 is the determined cDNA sequence for contig 28.
SEQ ID NO: 70 is the determined cDNA sequence for contig 29.
SEQ ID NO: 71 is the determined cDNA sequence for contig 30.
SEQ ID NO: 72 is the determined cDNA sequence for contig 31.
15 SEQ ID NO: 73 is the determined cDNA sequence for contig 32.
SEQ ID NO: 74 is the determined cDNA sequence for contig 33.
SEQ ID NO: 75 is the determined cDNA sequence for contig 34.
SEQ ID NO: 76 is the determined cDNA sequence for contig 35.
SEQ ID NO: 77 is the determined cDNA sequence for contig 36.
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SEQ ID NO: 79 is the determined cDNA sequence for contig 38.
SEQ ID NO: 80 is the determined cDNA sequence for contig 39.
SEQ ID NO: 81 is the determined cDNA sequence for contig 40.
SEQ ID NO: 82 is the determined cDNA sequence for contig 41.
25 SEQ ID NO: 83 is the determined cDNA sequence for contig 42.
SEQ ID NO: 84 is the determined cDNA sequence for contig 43.
SEQ ID NO: 85 is the determined cDNA sequence for contig 44.
SEQ ID NO: 85 is the determined cDNA sequence for contig 45.
SEQ ID NO: 85 is the determined cDNA sequence for contig 46.
30 SEQ ID NO: 88 is the determined cDNA sequence for contig 47.
SEQ ID NO: 89 is the determined cDNA sequence for contig 48.

SEQ ID NO: 90 is the determined cDNA sequence for contig 49.
SEQ ID NO: 91 is the determined cDNA sequence for contig 50.
SEQ ID NO: 92 is the determined cDNA sequence for contig 51.
SEQ ID NO: 93 is the determined cDNA sequence for contig 52.
5 SEQ ID NO: 94 is the determined cDNA sequence for contig 53.
SEQ ID NO: 95 is the determined cDNA sequence for contig 54.
SEQ ID NO: 96 is the determined cDNA sequence for contig 55.
SEQ ID NO: 97 is the determined cDNA sequence for contig 56.
SEQ ID NO: 98 is the determined cDNA sequence for contig 57.
10 SEQ ID NO: 99 is the determined cDNA sequence for contig 58.
SEQ ID NO: 100 is the determined cDNA sequence for contig 59.
SEQ ID NO: 101 is the determined cDNA sequence for contig 60.
SEQ ID NO: 102 is the determined cDNA sequence for contig 61.
SEQ ID NO: 103 is the determined cDNA sequence for contig 62.
15 SEQ ID NO: 104 is the determined cDNA sequence for contig 63.
SEQ ID NO: 105 is the determined cDNA sequence for contig 64.
SEQ ID NO: 106 is the determined cDNA sequence for contig 65.
SEQ ID NO: 107 is the determined cDNA sequence for contig 66.
SEQ ID NO: 108 is the determined cDNA sequence for contig 67.
20 SEQ ID NO: 109 is the determined cDNA sequence for contig 68.
SEQ ID NO: 110 is the determined cDNA sequence for contig 69.
SEQ ID NO: 111 is the determined cDNA sequence for contig 70.
SEQ ID NO: 112 is the determined cDNA sequence for contig 71.
SEQ ID NO: 113 is the determined cDNA sequence for contig 72.
25 SEQ ID NO: 114 is the determined cDNA sequence for contig 73.
SEQ ID NO: 115 is the determined cDNA sequence for contig 74.
SEQ ID NO: 116 is the determined cDNA sequence for contig 75.
SEQ ID NO: 117 is the determined cDNA sequence for contig 76.
SEQ ID NO: 118 is the determined cDNA sequence for contig 77.
30 SEQ ID NO: 119 is the determined cDNA sequence for contig 78.
SEQ ID NO: 120 is the determined cDNA sequence for contig 79.

SEQ ID NO: 121 is the determined cDNA sequence for contig 80.
SEQ ID NO: 122 is the determined cDNA sequence for contig 81.
SEQ ID NO: 123 is the determined cDNA sequence for contig 82.
SEQ ID NO: 124 is the determined cDNA sequence for contig 83.
5 SEQ ID NO: 125 is the determined cDNA sequence for contig 84.
SEQ ID NO: 126 is the determined cDNA sequence for contig 85.
SEQ ID NO: 127 is the determined cDNA sequence for contig 86.
SEQ ID NO: 128 is the determined cDNA sequence for contig 87.
SEQ ID NO: 129 is the determined cDNA sequence for contig 88.
10 SEQ ID NO: 130 is the determined cDNA sequence for contig 89.
SEQ ID NO: 131 is the determined cDNA sequence for contig 90.
SEQ ID NO: 132 is the determined cDNA sequence for contig 91.
SEQ ID NO: 133 is the determined cDNA sequence for contig 92.
SEQ ID NO: 134 is the determined cDNA sequence for contig 93.
15 SEQ ID NO: 135 is the determined cDNA sequence for contig 94.
SEQ ID NO: 136 is the determined cDNA sequence for contig 95.
SEQ ID NO: 137 is the determined cDNA sequence for contig 96.
SEQ ID NO: 138 is the determined cDNA sequence for clone 47589.
SEQ ID NO: 139 is the determined cDNA sequence for clone 47578.
20 SEQ ID NO: 140 is the determined cDNA sequence for clone 47602.
SEQ ID NO: 141 is the determined cDNA sequence for clone 47593.
SEQ ID NO: 142 is the determined cDNA sequence for clone 47583.
SEQ ID NO: 143 is the determined cDNA sequence for clone 47624.
SEQ ID NO: 144 is the determined cDNA sequence for clone 47622.
25 SEQ ID NO: 145 is the determined cDNA sequence for clone 47649.
SEQ ID NO: 146 is the determined cDNA sequence for clone 48955.
SEQ ID NO: 147 is the determined cDNA sequence for clone 48962.
SEQ ID NO: 148 is the determined cDNA sequence for clone 48964.
SEQ ID NO: 149 is the determined cDNA sequence for clone 48987.
30 SEQ ID NO: 150 is the determined cDNA sequence for clone 49002.
SEQ ID NO: 151 is the determined cDNA sequence for clone 48950.

SEQ ID NO: 152 is the determined cDNA sequence for clone 48934.
SEQ ID NO: 153 is the determined cDNA sequence for clone 48960.
SEQ ID NO: 154 is the determined cDNA sequence for clone 48931.
SEQ ID NO: 155 is the determined cDNA sequence for clone 48935.
5 SEQ ID NO: 156 is the determined cDNA sequence for clone 48940.
SEQ ID NO: 157 is the determined cDNA sequence for clone 48936.
SEQ ID NO: 158 is the determined cDNA sequence for clone 48930.
SEQ ID NO: 159 is the determined cDNA sequence for clone 48956.
SEQ ID NO: 160 is the determined cDNA sequence for clone 48959.
10 SEQ ID NO: 161 is the determined cDNA sequence for clone 48949.
SEQ ID NO: 162 is the determined cDNA sequence for clone 48965.
SEQ ID NO: 163 is the determined cDNA sequence for clone 48970.
SEQ ID NO: 164 is the determined cDNA sequence for clone 48984.
SEQ ID NO: 165 is the determined cDNA sequence for clone 48969.
15 SEQ ID NO: 166 is the determined cDNA sequence for clone 48978.
SEQ ID NO: 167 is the determined cDNA sequence for clone 48968.
SEQ ID NO: 168 is the determined cDNA sequence for clone 48929.
SEQ ID NO: 169 is the determined cDNA sequence for clone 48937.
SEQ ID NO: 170 is the determined cDNA sequence for clone 48982.
20 SEQ ID NO: 171 is the determined cDNA sequence for clone 48983.
SEQ ID NO: 172 is the determined cDNA sequence for clone 48997.
SEQ ID NO: 173 is the determined cDNA sequence for clone 48992.
SEQ ID NO: 174 is the determined cDNA sequence for clone 49006.
SEQ ID NO: 175 is the determined cDNA sequence for clone 48994.
25 SEQ ID NO: 176 is the determined cDNA sequence for clone 49013.
SEQ ID NO: 177 is the determined cDNA sequence for clone 49008.
SEQ ID NO: 178 is the determined cDNA sequence for clone 48990.
SEQ ID NO: 179 is the determined cDNA sequence for clone 48989.
SEQ ID NO: 180 is the determined cDNA sequence for clone 49014.
30 SEQ ID NO: 181 is the determined cDNA sequence for clone 48988.
SEQ ID NO: 182 is the determined cDNA sequence for clone 49018.

SEQ ID NO: 183 is the determined cDNA sequence for clone 6921.
SEQ ID NO: 184 is the determined cDNA sequence for clone 6837.
SEQ ID NO: 185 is the determined cDNA sequence for clone 6840.
SEQ ID NO: 186 is the determined cDNA sequence for clone 6844.
5 SEQ ID NO: 187 is the determined cDNA sequence for clone 6854.
SEQ ID NO: 188 is the determined cDNA sequence for clone 6872.
SEQ ID NO: 189 is the determined cDNA sequence for clone 6906.
SEQ ID NO: 190 is the determined cDNA sequence for clone 6908.
SEQ ID NO: 191 is the determined cDNA sequence for clone 6910.
10 SEQ ID NO: 192 is the determined cDNA sequence for clone 6912.
SEQ ID NO: 193 is the determined cDNA sequence for clone 6913.
SEQ ID NO: 194 is the determined cDNA sequence for clone 6914.
SEQ ID NO: 195 is the determined cDNA sequence for clone 6916.
SEQ ID NO: 196 is the determined cDNA sequence for clone 6918.
15 SEQ ID NO: 197 is the determined cDNA sequence for clone 6924.
SEQ ID NO: 198 is the determined cDNA sequence for clone 6928.
SEQ ID NO: 199 is the determined cDNA sequence for clone 6978A.
SEQ ID NO: 200 is the determined cDNA sequence for clone 6978B.
SEQ ID NO: 201 is the determined cDNA sequence for clone 6982A.
20 SEQ ID NO: 202 is the determined cDNA sequence for clone 6982B.
SEQ ID NO: 203 is the determined cDNA sequence for clone 6850.
SEQ ID NO: 204 is the determined cDNA sequence for clone 6860.
SEQ ID NO: 205 is the determined cDNA sequence for O772P.
SEQ ID NO: 206 is the amino acid sequence encoded by SEQ ID NO:
25 205.
SEQ ID NO: 207 is the full-length cDNA sequence for O8E.
SEQ ID NO: 208 is a first amino acid sequence encoded by SEQ ID NO:
207.
SEQ ID NO: 209 is a second amino acid sequence encoded by SEQ ID
30 NO: 209.

SEQ ID NO: 210-290 are determined cDNA sequence of breast-tumor specific clones.

DETAILED DESCRIPTION OF THE INVENTION

As noted above, the present invention is generally directed to compositions and methods for using the compositions, for example in the therapy and diagnosis of cancer, such as breast cancer. Certain illustrative compositions described herein include breast tumor polypeptides, polynucleotides encoding such polypeptides, binding agents such as antibodies, antigen presenting cells (APCs) and/or immune system cells (*e.g.*, T cells). A "breast tumor protein," as the term is used herein, refers generally to a protein that is expressed in breast tumor cells at a level that is at least two fold, and preferably at least five fold, greater than the level of expression in other normal tissues, as determined using a representative assay provided herein. Certain breast tumor proteins are tumor proteins that react detectably (within an immunoassay, such as an ELISA or Western blot) with antisera of a patient afflicted with breast cancer.

Therefore, in accordance with the above, and as described further below, the present invention provides illustrative polynucleotide compositions having sequences set forth in SEQ ID NO:1-38, 42-204, 205, 207 and 210-290, polypeptides encoded by such polynucleotides, antibody compositions capable of binding such polypeptides, and numerous additional embodiments employing such compositions, for example in the detection, diagnosis and/or therapy of human breast cancer.

POLYNUCLEOTIDE COMPOSITIONS

As used herein, the terms "DNA segment" and "polynucleotide" refer to a DNA molecule that has been isolated free of total genomic DNA of a particular species. Therefore, a DNA segment encoding a polypeptide refers to a DNA segment that contains one or more coding sequences yet is substantially isolated away from, or purified free from, total genomic DNA of the species from which the DNA segment is obtained. Included within the terms "DNA segment" and "polynucleotide" are DNA

segments and smaller fragments of such segments, and also recombinant vectors, including, for example, plasmids, cosmids, phagemids, phage, viruses, and the like.

As will be understood by those skilled in the art, the DNA segments of this invention can include genomic sequences, extra-genomic and plasmid-encoded
5 sequences and smaller engineered gene segments that express, or may be adapted to express, proteins, polypeptides, peptides and the like. Such segments may be naturally isolated, or modified synthetically by the hand of man.

"Isolated," as used herein, means that a polynucleotide is substantially away from other coding sequences, and that the DNA segment does not contain large
10 portions of unrelated coding DNA, such as large chromosomal fragments or other functional genes or polypeptide coding regions. Of course, this refers to the DNA segment as originally isolated, and does not exclude genes or coding regions later added to the segment by the hand of man.

As will be recognized by the skilled artisan, polynucleotides may be
15 single-stranded (coding or antisense) or double-stranded, and may be DNA (genomic, cDNA or synthetic) or RNA molecules. RNA molecules include HnRNA molecules, which contain introns and correspond to a DNA molecule in a one-to-one manner, and mRNA molecules, which do not contain introns. Additional coding or non-coding sequences may, but need not, be present within a polynucleotide of the present
20 invention, and a polynucleotide may, but need not, be linked to other molecules and/or support materials.

Polynucleotides may comprise a native sequence (*i.e.*, an endogenous sequence that encodes a breast tumor protein or a portion thereof) or may comprise a variant, or a biological or antigenic functional equivalent of such a sequence.
25 Polynucleotide variants may contain one or more substitutions, additions, deletions and/or insertions, as further described below, preferably such that the immunogenicity of the encoded polypeptide is not diminished, relative to a native tumor protein. The effect on the immunogenicity of the encoded polypeptide may generally be assessed as described herein. The term "variants" also encompasses homologous genes of
30 xenogenic origin.

When comparing polynucleotide or polypeptide sequences, two sequences are said to be "identical" if the sequence of nucleotides or amino acids in the two sequences is the same when aligned for maximum correspondence, as described below. Comparisons between two sequences are typically performed by comparing the sequences over a comparison window to identify and compare local regions of sequence similarity. A "comparison window" as used herein, refers to a segment of at least about 20 contiguous positions, usually 30 to about 75, 40 to about 50, in which a sequence may be compared to a reference sequence of the same number of contiguous positions after the two sequences are optimally aligned.

Optimal alignment of sequences for comparison may be conducted using the Megalign program in the Lasergene suite of bioinformatics software (DNASTAR, Inc., Madison, WI), using default parameters. This program embodies several alignment schemes described in the following references: Dayhoff, M.O. (1978) A model of evolutionary change in proteins – Matrices for detecting distant relationships. In Dayhoff, M.O. (ed.) *Atlas of Protein Sequence and Structure*, National Biomedical Research Foundation, Washington DC Vol. 5, Suppl. 3, pp. 345-358; Hein J. (1990) Unified Approach to Alignment and Phylogenies pp. 626-645 *Methods in Enzymology* vol. 183, Academic Press, Inc., San Diego, CA; Higgins, D.G. and Sharp, P.M. (1989) *CABIOS* 5:151-153; Myers, E.W. and Muller W. (1988) *CABIOS* 4:11-17; Robinson, E.D. (1971) *Comb. Theor* 11:105; Santou, N. Nes, M. (1987) *Mol. Biol. Evol.* 4:406-425; Sneath, P.H.A. and Sokal, R.R. (1973) *Numerical Taxonomy – the Principles and Practice of Numerical Taxonomy*, Freeman Press, San Francisco, CA; Wilbur, W.J. and Lipman, D.J. (1983) *Proc. Natl. Acad. Sci. USA* 80:726-730.

Alternatively, optimal alignment of sequences for comparison may be conducted by the local identity algorithm of Smith and Waterman (1981) *Add. APL. Math* 2:482, by the identity alignment algorithm of Needleman and Wunsch (1970) *J. Mol. Biol.* 48:443, by the search for similarity methods of Pearson and Lipman (1988) *Proc. Natl. Acad. Sci. USA* 85: 2444, by computerized implementations of these algorithms (GAP, BESTFIT, BLAST, FASTA, and TFASTA in the Wisconsin Genetics Software Package, Genetics Computer Group (GCG), 575 Science Dr., Madison, WI), or by inspection.

One preferred example of algorithms that are suitable for determining percent sequence identity and sequence similarity are the BLAST and BLAST 2.0 algorithms, which are described in Altschul et al. (1977) *Nucl. Acids Res.* 25:3389-3402 and Altschul et al. (1990) *J. Mol. Biol.* 215:403-410, respectively. BLAST and BLAST 2.0 can be used, for example with the parameters described herein, to determine percent sequence identity for the polynucleotides and polypeptides of the invention. Software for performing BLAST analyses is publicly available through the National Center for Biotechnology Information. In one illustrative example, cumulative scores can be calculated using, for nucleotide sequences, the parameters M (reward score for a pair of matching residues; always >0) and N (penalty score for mismatching residues; always <0). For amino acid sequences, a scoring matrix can be used to calculate the cumulative score. Extension of the word hits in each direction are halted when: the cumulative alignment score falls off by the quantity X from its maximum achieved value; the cumulative score goes to zero or below, due to the accumulation of one or more negative-scoring residue alignments; or the end of either sequence is reached. The BLAST algorithm parameters W, T and X determine the sensitivity and speed of the alignment. The BLASTN program (for nucleotide sequences) uses as defaults a wordlength (W) of 11, and expectation (E) of 10, and the BLOSUM62 scoring matrix (see Henikoff and Henikoff (1989) *Proc. Natl. Acad. Sci. USA* 89:10915) alignments, (B) of 50, expectation (E) of 10, M=5, N=-4 and a comparison of both strands.

Preferably, the "percentage of sequence identity" is determined by comparing two optimally aligned sequences over a window of comparison of at least 20 positions, wherein the portion of the polynucleotide or polypeptide sequence in the comparison window may comprise additions or deletions (*i.e.*, gaps) of 20 percent or less, usually 5 to 15 percent, or 10 to 12 percent, as compared to the reference sequences (which does not comprise additions or deletions) for optimal alignment of the two sequences. The percentage is calculated by determining the number of positions at which the identical nucleic acid bases or amino acid residue occurs in both sequences to yield the number of matched positions, dividing the number of matched positions by the total number of positions in the reference sequence (*i.e.*, the window size) and multiplying the results by 100 to yield the percentage of sequence identity.

Therefore, the present invention encompasses polynucleotide and polypeptide sequences having substantial identity to the sequences disclosed herein, for example those comprising at least 50% sequence identity, preferably at least 55%, 60%, 65%, 70%, 75%, 80%, 85%, 90%, 95%, 96%, 97%, 98%, or 99% or higher, sequence
5 identity compared to a polynucleotide or polypeptide sequence of this invention using the methods described herein, (e.g., BLAST analysis using standard parameters, as described below). One skilled in this art will recognize that these values can be appropriately adjusted to determine corresponding identity of proteins encoded by two nucleotide sequences by taking into account codon degeneracy, amino acid similarity,
10 reading frame positioning and the like.

In additional embodiments, the present invention provides isolated polynucleotides and polypeptides comprising various lengths of contiguous stretches of sequence identical to or complementary to one or more of the sequences disclosed herein. For example, polynucleotides are provided by this invention that comprise at
15 least about 15, 20, 30, 40, 50, 75, 100, 150, 200, 300, 400, 500 or 1000 or more contiguous nucleotides of one or more of the sequences disclosed herein as well as all intermediate lengths there between. It will be readily understood that "intermediate lengths", in this context, means any length between the quoted values, such as 16, 17, 18, 19, *etc.*; 21, 22, 23, *etc.*; 30, 31, 32, *etc.*; 50, 51, 52, 53, *etc.*; 100, 101, 102, 103,
20 *etc.*; 150, 151, 152, 153, *etc.*; including all integers through 200-500; 500-1,000, and the like.

The polynucleotides of the present invention, or fragments thereof, regardless of the length of the coding sequence itself, may be combined with other DNA sequences, such as promoters, polyadenylation signals, additional restriction
25 enzyme sites, multiple cloning sites, other coding segments, and the like, such that their overall length may vary considerably. It is therefore contemplated that a nucleic acid fragment of almost any length may be employed, with the total length preferably being limited by the ease of preparation and use in the intended recombinant DNA protocol. For example, illustrative DNA segments with total lengths of about 10,000, about 5000,
30 about 3000, about 2,000, about 1,000, about 500, about 200, about 100, about 50 base

pairs in length, and the like, (including all intermediate lengths) are contemplated to be useful in many implementations of this invention.

In other embodiments, the present invention is directed to polynucleotides that are capable of hybridizing under moderately stringent conditions to a polynucleotide sequence provided herein, or a fragment thereof, or a complementary sequence thereof. Hybridization techniques are well known in the art of molecular biology. For purposes of illustration, suitable moderately stringent conditions for testing the hybridization of a polynucleotide of this invention with other polynucleotides include prewashing in a solution of 5 X SSC, 0.5% SDS, 1.0 mM EDTA (pH 8.0); hybridizing at 50°C-65°C, 5 X SSC, overnight; followed by washing twice at 65°C for 20 minutes with each of 2X, 0.5X and 0.2X SSC containing 0.1% SDS.

Moreover, it will be appreciated by those of ordinary skill in the art that, as a result of the degeneracy of the genetic code, there are many nucleotide sequences that encode a polypeptide as described herein. Some of these polynucleotides bear minimal homology to the nucleotide sequence of any native gene. Nonetheless, polynucleotides that vary due to differences in codon usage are specifically contemplated by the present invention. Further, alleles of the genes comprising the polynucleotide sequences provided herein are within the scope of the present invention. Alleles are endogenous genes that are altered as a result of one or more mutations, such as deletions, additions and/or substitutions of nucleotides. The resulting mRNA and protein may, but need not, have an altered structure or function. Alleles may be identified using standard techniques (such as hybridization, amplification and/or database sequence comparison).

25 PROBES AND PRIMERS

In other embodiments of the present invention, the polynucleotide sequences provided herein can be advantageously used as probes or primers for nucleic acid hybridization. As such, it is contemplated that nucleic acid segments that comprise a sequence region of at least about 15 nucleotide long contiguous sequence that has the same sequence as, or is complementary to, a 15 nucleotide long contiguous sequence

disclosed herein will find particular utility. Longer contiguous identical or complementary sequences, *e.g.*, those of about 20, 30, 40, 50, 100, 200, 500, 1000 (including all intermediate lengths) and even up to full length sequences will also be of use in certain embodiments.

5 The ability of such nucleic acid probes to specifically hybridize to a sequence of interest will enable them to be of use in detecting the presence of complementary sequences in a given sample. However, other uses are also envisioned, such as the use of the sequence information for the preparation of mutant species primers, or primers for use in preparing other genetic constructions.

10 Polynucleotide molecules having sequence regions consisting of contiguous nucleotide stretches of 10-14, 15-20, 30, 50, or even of 100-200 nucleotides or so (including intermediate lengths as well), identical or complementary to a polynucleotide sequence disclosed herein, are particularly contemplated as hybridization probes for use in, *e.g.*, Southern and Northern blotting. This would allow
15 a gene product, or fragment thereof, to be analyzed, both in diverse cell types and also in various bacterial cells. The total size of fragment, as well as the size of the complementary stretch(es), will ultimately depend on the intended use or application of the particular nucleic acid segment. Smaller fragments will generally find use in hybridization embodiments, wherein the length of the contiguous complementary
20 region may be varied, such as between about 15 and about 100 nucleotides, but larger contiguous complementarity stretches may be used, according to the length complementary sequences one wishes to detect.

 The use of a hybridization probe of about 15-25 nucleotides in length allows the formation of a duplex molecule that is both stable and selective. Molecules
25 having contiguous complementary sequences over stretches greater than 15 bases in length are generally preferred, though, in order to increase stability and selectivity of the hybrid, and thereby improve the quality and degree of specific hybrid molecules obtained. One will generally prefer to design nucleic acid molecules having gene-complementary stretches of 15 to 25 contiguous nucleotides, or even longer where
30 desired.

Hybridization probes may be selected from any portion of any of the sequences disclosed herein. All that is required is to review the sequence set forth in SEQ ID NO: 1-38, 42-204, 205, 207 and 210-290, or to any continuous portion of the sequence, from about 15-25 nucleotides in length up to and including the full length
5 sequence, that one wishes to utilize as a probe or primer. The choice of probe and primer sequences may be governed by various factors. For example, one may wish to employ primers from towards the termini of the total sequence.

Small polynucleotide segments or fragments may be readily prepared by, for example, directly synthesizing the fragment by chemical means, as is commonly
10 practiced using an automated oligonucleotide synthesizer. Also, fragments may be obtained by application of nucleic acid reproduction technology, such as the PCRTM technology of U. S. Patent 4,683,202 (incorporated herein by reference), by introducing selected sequences into recombinant vectors for recombinant production, and by other recombinant DNA techniques generally known to those of skill in the art of molecular
15 biology.

The nucleotide sequences of the invention may be used for their ability to selectively form duplex molecules with complementary stretches of the entire gene or gene fragments of interest. Depending on the application envisioned, one will typically desire to employ varying conditions of hybridization to achieve varying degrees of
20 selectivity of probe towards target sequence. For applications requiring high selectivity, one will typically desire to employ relatively stringent conditions to form the hybrids, *e.g.*, one will select relatively low salt and/or high temperature conditions, such as provided by a salt concentration of from about 0.02 M to about 0.15 M salt at temperatures of from about 50°C to about 70°C. Such selective conditions tolerate
25 little, if any, mismatch between the probe and the template or target strand, and would be particularly suitable for isolating related sequences.

Of course, for some applications, for example, where one desires to prepare mutants employing a mutant primer strand hybridized to an underlying template, less stringent (reduced stringency) hybridization conditions will typically be
30 needed in order to allow formation of the heteroduplex. In these circumstances, one may desire to employ salt conditions such as those of from about 0.15 M to about 0.9 M

salt, at temperatures ranging from about 20°C to about 55°C. Cross-hybridizing species can thereby be readily identified as positively hybridizing signals with respect to control hybridizations. In any case, it is generally appreciated that conditions can be rendered more stringent by the addition of increasing amounts of formamide, which serves to
5 destabilize the hybrid duplex in the same manner as increased temperature. Thus, hybridization conditions can be readily manipulated, and thus will generally be a method of choice depending on the desired results.

POLYNUCLEOTIDE IDENTIFICATION AND CHARACTERIZATION

Polynucleotides may be identified, prepared and/or manipulated using
10 any of a variety of well established techniques. For example, a polynucleotide may be identified, as described in more detail below, by screening a microarray of cDNAs for tumor-associated expression (*i.e.*, expression that is at least two fold greater in a tumor than in normal tissue, as determined using a representative assay provided herein). Such screens may be performed, for example, using a Synteni microarray (Palo Alto,
15 CA) according to the manufacturer's instructions (and essentially as described by Schena et al., *Proc. Natl. Acad. Sci. USA* 93:10614-10619, 1996 and Heller et al., *Proc. Natl. Acad. Sci. USA* 94:2150-2155, 1997). Alternatively, polynucleotides may be amplified from cDNA prepared from cells expressing the proteins described herein, such as breast tumor cells. Such polynucleotides may be amplified via polymerase
20 chain reaction (PCR). For this approach, sequence-specific primers may be designed based on the sequences provided herein, and may be purchased or synthesized.

An amplified portion of a polynucleotide of the present invention may be used to isolate a full length gene from a suitable library (*e.g.*, a breast tumor cDNA library) using well known techniques. Within such techniques, a library (cDNA or
25 genomic) is screened using one or more polynucleotide probes or primers suitable for amplification. Preferably, a library is size-selected to include larger molecules. Random primed libraries may also be preferred for identifying 5' and upstream regions of genes. Genomic libraries are preferred for obtaining introns and extending 5' sequences.

For hybridization techniques, a partial sequence may be labeled (*e.g.*, by nick-translation or end-labeling with ^{32}P) using well known techniques. A bacterial or bacteriophage library is then generally screened by hybridizing filters containing denatured bacterial colonies (or lawns containing phage plaques) with the labeled probe
5 (see Sambrook et al., *Molecular Cloning: A Laboratory Manual*, Cold Spring Harbor Laboratories, Cold Spring Harbor, NY, 1989). Hybridizing colonies or plaques are selected and expanded, and the DNA is isolated for further analysis. cDNA clones may be analyzed to determine the amount of additional sequence by, for example, PCR using a primer from the partial sequence and a primer from the vector. Restriction maps and
10 partial sequences may be generated to identify one or more overlapping clones. The complete sequence may then be determined using standard techniques, which may involve generating a series of deletion clones. The resulting overlapping sequences can then be assembled into a single contiguous sequence. A full length cDNA molecule can be generated by ligating suitable fragments, using well known techniques.

15 Alternatively, there are numerous amplification techniques for obtaining a full length coding sequence from a partial cDNA sequence. Within such techniques, amplification is generally performed via PCR. Any of a variety of commercially available kits may be used to perform the amplification step. Primers may be designed using, for example, software well known in the art. Primers are preferably 22-30
20 nucleotides in length, have a GC content of at least 50% and anneal to the target sequence at temperatures of about 68°C to 72°C. The amplified region may be sequenced as described above, and overlapping sequences assembled into a contiguous sequence.

One such amplification technique is inverse PCR (*see* Triglia et al., *Nucl. Acids Res.* 16:8186, 1988), which uses restriction enzymes to generate a fragment in the
25 known region of the gene. The fragment is then circularized by intramolecular ligation and used as a template for PCR with divergent primers derived from the known region. Within an alternative approach, sequences adjacent to a partial sequence may be retrieved by amplification with a primer to a linker sequence and a primer specific to a
30 known region. The amplified sequences are typically subjected to a second round of amplification with the same linker primer and a second primer specific to the known

region. A variation on this procedure, which employs two primers that initiate extension in opposite directions from the known sequence, is described in WO 96/38591. Another such technique is known as "rapid amplification of cDNA ends" or RACE. This technique involves the use of an internal primer and an external primer, which hybridizes to a polyA region or vector sequence, to identify sequences that are 5' and 3' of a known sequence. Additional techniques include capture PCR (Lagerstrom et al., *PCR Methods Applic. 1*:111-19, 1991) and walking PCR (Parker et al., *Nucl. Acids. Res. 19*:3055-60, 1991). Other methods employing amplification may also be employed to obtain a full length cDNA sequence.

10 In certain instances, it is possible to obtain a full length cDNA sequence by analysis of sequences provided in an expressed sequence tag (EST) database, such as that available from GenBank. Searches for overlapping ESTs may generally be performed using well known programs (*e.g.*, NCBI BLAST searches), and such ESTs may be used to generate a contiguous full length sequence. Full length DNA sequences
15 may also be obtained by analysis of genomic fragments.

POLYNUCLEOTIDE EXPRESSION IN HOST CELLS

In other embodiments of the invention, polynucleotide sequences or fragments thereof which encode polypeptides of the invention, or fusion proteins or functional equivalents thereof, may be used in recombinant DNA molecules to direct
20 expression of a polypeptide in appropriate host cells. Due to the inherent degeneracy of the genetic code, other DNA sequences that encode substantially the same or a functionally equivalent amino acid sequence may be produced and these sequences may be used to clone and express a given polypeptide.

As will be understood by those of skill in the art, it may be advantageous
25 in some instances to produce polypeptide-encoding nucleotide sequences possessing non-naturally occurring codons. For example, codons preferred by a particular prokaryotic or eukaryotic host can be selected to increase the rate of protein expression or to produce a recombinant RNA transcript having desirable properties, such as a half-life which is longer than that of a transcript generated from the naturally occurring
30 sequence.

Moreover, the polynucleotide sequences of the present invention can be engineered using methods generally known in the art in order to alter polypeptide encoding sequences for a variety of reasons, including but not limited to, alterations which modify the cloning, processing, and/or expression of the gene product. For example, DNA shuffling by random fragmentation and PCR reassembly of gene fragments and synthetic oligonucleotides may be used to engineer the nucleotide sequences. In addition, site-directed mutagenesis may be used to insert new restriction sites, alter glycosylation patterns, change codon preference, produce splice variants, or introduce mutations, and so forth.

10 In another embodiment of the invention, natural, modified, or recombinant nucleic acid sequences may be ligated to a heterologous sequence to encode a fusion protein. For example, to screen peptide libraries for inhibitors of polypeptide activity, it may be useful to encode a chimeric protein that can be recognized by a commercially available antibody. A fusion protein may also be engineered to contain a cleavage site located between the polypeptide-encoding sequence and the heterologous protein sequence, so that the polypeptide may be cleaved and purified away from the heterologous moiety.

Sequences encoding a desired polypeptide may be synthesized, in whole or in part, using chemical methods well known in the art (see Caruthers, M. H. et al. 20 (1980) *Nucl. Acids Res. Symp. Ser.* 215-223, Horn, T. et al. (1980) *Nucl. Acids Res. Symp. Ser.* 225-232). Alternatively, the protein itself may be produced using chemical methods to synthesize the amino acid sequence of a polypeptide, or a portion thereof. For example, peptide synthesis can be performed using various solid-phase techniques (Roberge, J. Y. et al. (1995) *Science* 269:202-204) and automated synthesis may be achieved, for example, using the ABI 431A Peptide Synthesizer (Perkin Elmer, Palo Alto, CA).

A newly synthesized peptide may be substantially purified by preparative high performance liquid chromatography (e.g., Creighton, T. (1983) *Proteins, Structures and Molecular Principles*, WH Freeman and Co., New York, N.Y.) or other comparable techniques available in the art. The composition of the synthetic peptides may be confirmed by amino acid analysis or sequencing (e.g., the Edman

degradation procedure). Additionally, the amino acid sequence of a polypeptide, or any part thereof, may be altered during direct synthesis and/or combined using chemical methods with sequences from other proteins, or any part thereof, to produce a variant polypeptide.

5 In order to express a desired polypeptide, the nucleotide sequences encoding the polypeptide, or functional equivalents, may be inserted into appropriate expression vector, i.e., a vector which contains the necessary elements for the transcription and translation of the inserted coding sequence. Methods which are well known to those skilled in the art may be used to construct expression vectors containing
10 sequences encoding a polypeptide of interest and appropriate transcriptional and translational control elements. These methods include in vitro recombinant DNA techniques, synthetic techniques, and in vivo genetic recombination. Such techniques are described in Sambrook, J. et al. (1989) *Molecular Cloning, A Laboratory Manual*, Cold Spring Harbor Press, Plainview, N.Y., and Ausubel, F. M. et al. (1989) *Current*
15 *Protocols in Molecular Biology*, John Wiley & Sons, New York. N.Y.

A variety of expression vector/host systems may be utilized to contain and express polynucleotide sequences. These include, but are not limited to, microorganisms such as bacteria transformed with recombinant bacteriophage, plasmid, or cosmid DNA expression vectors; yeast transformed with yeast expression vectors;
20 insect cell systems infected with virus expression vectors (e.g., baculovirus); plant cell systems transformed with virus expression vectors (e.g., cauliflower mosaic virus, CaMV; tobacco mosaic virus, TMV) or with bacterial expression vectors (e.g., Ti or pBR322 plasmids); or animal cell systems.

The "control elements" or "regulatory sequences" present in an
25 expression vector are those non-translated regions of the vector--enhancers, promoters, 5' and 3' untranslated regions--which interact with host cellular proteins to carry out transcription and translation. Such elements may vary in their strength and specificity. Depending on the vector system and host utilized, any number of suitable transcription and translation elements, including constitutive and inducible promoters, may be used.
30 For example, when cloning in bacterial systems, inducible promoters such as the hybrid lacZ promoter of the PBLUESCRIPT phagemid (Stratagene, La Jolla, Calif.) or

PSPORT1 plasmid (Gibco BRL, Gaithersburg, MD) and the like may be used. In mammalian cell systems, promoters from mammalian genes or from mammalian viruses are generally preferred. If it is necessary to generate a cell line that contains multiple copies of the sequence encoding a polypeptide, vectors based on SV40 or EBV
5 may be advantageously used with an appropriate selectable marker.

In bacterial systems, a number of expression vectors may be selected depending upon the use intended for the expressed polypeptide. For example, when large quantities are needed, for example for the induction of antibodies, vectors which direct high level expression of fusion proteins that are readily purified may be used:
10 Such vectors include, but are not limited to, the multifunctional *E. coli* cloning and expression vectors such as BLUESCRIPT (Stratagene), in which the sequence encoding the polypeptide of interest may be ligated into the vector in frame with sequences for the amino-terminal Met and the subsequent 7 residues of .beta.-galactosidase so that a hybrid protein is produced; pIN vectors (Van Heeke, G. and S. M. Schuster (1989) *J.*
15 *Biol. Chem.* 264:5503-5509); and the like. pGEX Vectors (Promega, Madison, Wis.) may also be used to express foreign polypeptides as fusion proteins with glutathione S-transferase (GST). In general, such fusion proteins are soluble and can easily be purified from lysed cells by adsorption to glutathione-agarose beads followed by elution in the presence of free glutathione. Proteins made in such systems may be designed to include
20 heparin, thrombin, or factor XA protease cleavage sites so that the cloned polypeptide of interest can be released from the GST moiety at will.

In the yeast, *Saccharomyces cerevisiae*, a number of vectors containing constitutive or inducible promoters such as alpha factor, alcohol oxidase, and PGH may be used. For reviews, see Ausubel et al. (supra) and Grant et al. (1987) *Methods*
25 *Enzymol.* 153:516-544.

In cases where plant expression vectors are used, the expression of sequences encoding polypeptides may be driven by any of a number of promoters. For example, viral promoters such as the 35S and 19S promoters of CaMV may be used alone or in combination with the omega leader sequence from TMV (Takamatsu, N.
30 (1987) *EMBO J.* 6:307-311. Alternatively, plant promoters such as the small subunit of RUBISCO or heat shock promoters may be used (Coruzzi, G. et al. (1984) *EMBO J.*

3:1671-1680; Broglie, R. et al. (1984) *Science* 224:838-843; and Winter, J. et al. (1991) *Results Probl. Cell Differ.* 17:85-105). These constructs can be introduced into plant cells by direct DNA transformation or pathogen-mediated transfection. Such techniques are described in a number of generally available reviews (see, for example, Hobbs, S. or
5 Murry, L. E. in McGraw Hill Yearbook of Science and Technology (1992) McGraw Hill, New York, N.Y.; pp. 191-196).

An insect system may also be used to express a polypeptide of interest. For example, in one such system, Autographa californica nuclear polyhedrosis virus (AcNPV) is used as a vector to express foreign genes in *Spodoptera frugiperda* cells or
10 in *Trichoplusia* larvae. The sequences encoding the polypeptide may be cloned into a non-essential region of the virus, such as the polyhedrin gene, and placed under control of the polyhedrin promoter. Successful insertion of the polypeptide-encoding sequence will render the polyhedrin gene inactive and produce recombinant virus lacking coat protein. The recombinant viruses may then be used to infect, for example, *S. frugiperda*
15 cells or *Trichoplusia* larvae in which the polypeptide of interest may be expressed (Engelhard, E. K. et al. (1994) *Proc. Natl. Acad. Sci.* 91 :3224-3227).

In mammalian host cells, a number of viral-based expression systems are generally available. For example, in cases where an adenovirus is used as an expression vector, sequences encoding a polypeptide of interest may be ligated into an adenovirus
20 transcription/translation complex consisting of the late promoter and tripartite leader sequence. Insertion in a non-essential E1 or E3 region of the viral genome may be used to obtain a viable virus which is capable of expressing the polypeptide in infected host cells (Logan, J. and Shenk, T. (1984) *Proc. Natl. Acad. Sci.* 81:3655-3659). In addition, transcription enhancers, such as the Rous sarcoma virus (RSV) enhancer, may be used
25 to increase expression in mammalian host cells.

Specific initiation signals may also be used to achieve more efficient translation of sequences encoding a polypeptide of interest. Such signals include the ATG initiation codon and adjacent sequences. In cases where sequences encoding the polypeptide, its initiation codon, and upstream sequences are inserted into the
30 appropriate expression vector, no additional transcriptional or translational control signals may be needed. However, in cases where only coding sequence, or a portion

thereof, is inserted, exogenous translational control signals including the ATG initiation codon should be provided. Furthermore, the initiation codon should be in the correct reading frame to ensure translation of the entire insert. Exogenous translational elements and initiation codons may be of various origins, both natural and synthetic.

- 5 The efficiency of expression may be enhanced by the inclusion of enhancers which are appropriate for the particular cell system which is used, such as those described in the literature (Scharf, D. et al. (1994) *Results Probl. Cell Differ.* 20:125-162).

In addition, a host cell strain may be chosen for its ability to modulate the expression of the inserted sequences or to process the expressed protein in the
10 desired fashion. Such modifications of the polypeptide include, but are not limited to, acetylation, carboxylation, glycosylation, phosphorylation, lipidation, and acylation. Post-translational processing which cleaves a "prepro" form of the protein may also be used to facilitate correct insertion, folding and/or function. Different host cells such as CHO, HeLa, MDCK, HEK293, and WI38, which have specific cellular machinery and
15 characteristic mechanisms for such post-translational activities, may be chosen to ensure the correct modification and processing of the foreign protein.

For long-term, high-yield production of recombinant proteins, stable expression is generally preferred. For example, cell lines which stably express a polynucleotide of interest may be transformed using expression vectors which may
20 contain viral origins of replication and/or endogenous expression elements and a selectable marker gene on the same or on a separate vector. Following the introduction of the vector, cells may be allowed to grow for 1-2 days in an enriched media before they are switched to selective media. The purpose of the selectable marker is to confer resistance to selection, and its presence allows growth and recovery of cells which
25 successfully express the introduced sequences. Resistant clones of stably transformed cells may be proliferated using tissue culture techniques appropriate to the cell type.

Any number of selection systems may be used to recover transformed cell lines. These include, but are not limited to, the herpes simplex virus thymidine kinase (Wigler, M. et al. (1977) *Cell* 11:223-32) and adenine phosphoribosyltransferase
30 (Lowy, I. et al. (1990) *Cell* 22:817-23) genes which can be employed in tk.sup.- or aprt.sup.- cells, respectively. Also, antimetabolite, antibiotic or herbicide resistance can

be used as the basis for selection; for example, dhfr which confers resistance to methotrexate (Wigler, M. et al. (1980) *Proc. Natl. Acad. Sci.* 77:3567-70); npt, which confers resistance to the aminoglycosides, neomycin and G-418 (Colbere-Garapin, F. et al (1981) *J. Mol. Biol.* 150:1-14); and als or pat, which confer resistance to
5 chlorsulfuron and phosphinotricin acetyltransferase, respectively (Murry, *supra*). Additional selectable genes have been described, for example, trpB, which allows cells to utilize indole in place of tryptophan, or hisD, which allows cells to utilize histinol in place of histidine (Hartman, S. C. and R. C. Mulligan (1988) *Proc. Natl. Acad. Sci.* 85:8047-51). Recently, the use of visible markers has gained popularity with such
10 markers as anthocyanins, beta-glucuronidase and its substrate GUS, and luciferase and its substrate luciferin, being widely used not only to identify transformants, but also to quantify the amount of transient or stable protein expression attributable to a specific vector system (Rhodes, C. A. et al. (1995) *Methods Mol. Biol.* 55:121-131).

Although the presence/absence of marker gene expression suggests that
15 the gene of interest is also present, its presence and expression may need to be confirmed. For example, if the sequence encoding a polypeptide is inserted within a marker gene sequence, recombinant cells containing sequences can be identified by the absence of marker gene function. Alternatively, a marker gene can be placed in tandem with a polypeptide-encoding sequence under the control of a single promoter.
20 Expression of the marker gene in response to induction or selection usually indicates expression of the tandem gene as well.

Alternatively, host cells which contain and express a desired polynucleotide sequence may be identified by a variety of procedures known to those of skill in the art. These procedures include, but are not limited to, DNA-DNA or DNA-
25 RNA hybridizations and protein bioassay or immunoassay techniques which include membrane, solution, or chip based technologies for the detection and/or quantification of nucleic acid or protein.

A variety of protocols for detecting and measuring the expression of polynucleotide-encoded products, using either polyclonal or monoclonal antibodies
30 specific for the product are known in the art. Examples include enzyme-linked immunosorbent assay (ELISA), radioimmunoassay (RIA), and fluorescence activated

cell sorting (FACS). A two-site, monoclonal-based immunoassay utilizing monoclonal antibodies reactive to two non-interfering epitopes on a given polypeptide may be preferred for some applications, but a competitive binding assay may also be employed. These and other assays are described, among other places, in Hampton, R. et al. (1990; 5 Serological Methods, a Laboratory Manual, APS Press, St Paul, Minn.) and Maddox, D. E. et al. (1983; *J. Exp. Med.* 158:1211-1216).

A wide variety of labels and conjugation techniques are known by those skilled in the art and may be used in various nucleic acid and amino acid assays. Means for producing labeled hybridization or PCR probes for detecting sequences related to 10 polynucleotides include oligolabeling, nick translation, end-labeling or PCR amplification using a labeled nucleotide. Alternatively, the sequences, or any portions thereof may be cloned into a vector for the production of an mRNA probe. Such vectors are known in the art, are commercially available, and may be used to synthesize RNA probes in vitro by addition of an appropriate RNA polymerase such as T7, T3, or SP6 15 and labeled nucleotides. These procedures may be conducted using a variety of commercially available kits. Suitable reporter molecules or labels, which may be used include radionuclides, enzymes, fluorescent, chemiluminescent, or chromogenic agents as well as substrates, cofactors, inhibitors, magnetic particles, and the like.

Host cells transformed with a polynucleotide sequence of interest may be 20 cultured under conditions suitable for the expression and recovery of the protein from cell culture. The protein produced by a recombinant cell may be secreted or contained intracellularly depending on the sequence and/or the vector used. As will be understood by those of skill in the art, expression vectors containing polynucleotides of the invention may be designed to contain signal sequences which direct secretion of the 25 encoded polypeptide through a prokaryotic or eukaryotic cell membrane. Other recombinant constructions may be used to join sequences encoding a polypeptide of interest to nucleotide sequence encoding a polypeptide domain which will facilitate purification of soluble proteins. Such purification facilitating domains include, but are not limited to, metal chelating peptides such as histidine-tryptophan modules that allow 30 purification on immobilized metals, protein A domains that allow purification on immobilized immunoglobulin, and the domain utilized in the FLAGS extension/affinity

purification system (Immunex Corp., Seattle, Wash.). The inclusion of cleavable linker sequences such as those specific for Factor XA or enterokinase (Invitrogen, San Diego, Calif.) between the purification domain and the encoded polypeptide may be used to facilitate purification. One such expression vector provides for expression of a fusion
5 protein containing a polypeptide of interest and a nucleic acid encoding 6 histidine residues preceding a thioredoxin or an enterokinase cleavage site. The histidine residues facilitate purification on IMIAC (immobilized metal ion affinity chromatography) as described in Porath, J. et al. (1992, *Prot. Exp. Purif.* 3:263-281) while the enterokinase cleavage site provides a means for purifying the desired polypeptide from the fusion
10 protein. A discussion of vectors which contain fusion proteins is provided in Kroll, D. J. et al. (1993; *DNA Cell Biol.* 12:441-453).

In addition to recombinant production methods, polypeptides of the invention, and fragments thereof, may be produced by direct peptide synthesis using solid-phase techniques (Merrifield J. (1963) *J. Am. Chem. Soc.* 85:2149-2154). Protein
15 synthesis may be performed using manual techniques or by automation. Automated synthesis may be achieved, for example, using Applied Biosystems 431A Peptide Synthesizer (Perkin Elmer). Alternatively, various fragments may be chemically synthesized separately and combined using chemical methods to produce the full length molecule.

20 SITE-SPECIFIC MUTAGENESIS

Site-specific mutagenesis is a technique useful in the preparation of individual peptides, or biologically functional equivalent polypeptides, through specific mutagenesis of the underlying polynucleotides that encode them. The technique, well-known to those of skill in the art, further provides a ready ability to prepare and
25 test sequence variants, for example, incorporating one or more of the foregoing considerations, by introducing one or more nucleotide sequence changes into the DNA. Site-specific mutagenesis allows the production of mutants through the use of specific oligonucleotide sequences which encode the DNA sequence of the desired mutation, as well as a sufficient number of adjacent nucleotides, to provide a primer sequence of
30 sufficient size and sequence complexity to form a stable duplex on both sides of the

deletion junction being traversed. Mutations may be employed in a selected polynucleotide sequence to improve, alter, decrease, modify, or otherwise change the properties of the polynucleotide itself, and/or alter the properties, activity, composition, stability, or primary sequence of the encoded polypeptide.

5 In certain embodiments of the present invention, the inventors contemplate the mutagenesis of the disclosed polynucleotide sequences to alter one or more properties of the encoded polypeptide, such as the antigenicity of a polypeptide vaccine. The techniques of site-specific mutagenesis are well-known in the art, and are widely used to create variants of both polypeptides and polynucleotides. For example,
10 site-specific mutagenesis is often used to alter a specific portion of a DNA molecule. In such embodiments, a primer comprising typically about 14 to about 25 nucleotides or so in length is employed, with about 5 to about 10 residues on both sides of the junction of the sequence being altered.

As will be appreciated by those of skill in the art, site-specific
15 mutagenesis techniques have often employed a phage vector that exists in both a single stranded and double stranded form. Typical vectors useful in site-directed mutagenesis include vectors such as the M13 phage. These phage are readily commercially-available and their use is generally well-known to those skilled in the art. Double-stranded plasmids are also routinely employed in site directed mutagenesis that
20 eliminates the step of transferring the gene of interest from a plasmid to a phage.

In general, site-directed mutagenesis in accordance herewith is performed by first obtaining a single-stranded vector or melting apart of two strands of a double-stranded vector that includes within its sequence a DNA sequence that encodes the desired peptide. An oligonucleotide primer bearing the desired mutated sequence is
25 prepared, generally synthetically. This primer is then annealed with the single-stranded vector, and subjected to DNA polymerizing enzymes such as *E. coli* polymerase I Klenow fragment, in order to complete the synthesis of the mutation-bearing strand. Thus, a heteroduplex is formed wherein one strand encodes the original non-mutated sequence and the second strand bears the desired mutation. This heteroduplex vector is
30 then used to transform appropriate cells, such as *E. coli* cells, and clones are selected which include recombinant vectors bearing the mutated sequence arrangement.

The preparation of sequence variants of the selected peptide-encoding DNA segments using site-directed mutagenesis provides a means of producing potentially useful species and is not meant to be limiting as there are other ways in which sequence variants of peptides and the DNA sequences encoding them may be
5 obtained. For example, recombinant vectors encoding the desired peptide sequence may be treated with mutagenic agents, such as hydroxylamine, to obtain sequence variants. Specific details regarding these methods and protocols are found in the teachings of Maloy *et al.*, 1994; Segal, 1976; Prokop and Bajpai, 1991; Kuby, 1994; and Maniatis *et al.*, 1982, each incorporated herein by reference, for that purpose.

10 As used herein, the term "oligonucleotide directed mutagenesis procedure" refers to template-dependent processes and vector-mediated propagation which result in an increase in the concentration of a specific nucleic acid molecule relative to its initial concentration, or in an increase in the concentration of a detectable signal, such as amplification. As used herein, the term "oligonucleotide directed
15 mutagenesis procedure" is intended to refer to a process that involves the template-dependent extension of a primer molecule. The term template dependent process refers to nucleic acid synthesis of an RNA or a DNA molecule wherein the sequence of the newly synthesized strand of nucleic acid is dictated by the well-known rules of complementary base pairing (see, for example, Watson, 1987). Typically,
20 vector mediated methodologies involve the introduction of the nucleic acid fragment into a DNA or RNA vector, the clonal amplification of the vector, and the recovery of the amplified nucleic acid fragment. Examples of such methodologies are provided by U. S. Patent No. 4,237,224, specifically incorporated herein by reference in its entirety.

POLYNUCLEOTIDE AMPLIFICATION TECHNIQUES

25 A number of template dependent processes are available to amplify the target sequences of interest present in a sample. One of the best known amplification methods is the polymerase chain reaction (PCR™) which is described in detail in U.S. Patent Nos. 4,683,195, 4,683,202 and 4,800,159, each of which is incorporated herein by reference in its entirety. Briefly, in PCR™, two primer sequences are prepared
30 which are complementary to regions on opposite complementary strands of the target

sequence. An excess of deoxynucleoside triphosphates is added to a reaction mixture along with a DNA polymerase (e.g., *Taq* polymerase). If the target sequence is present in a sample, the primers will bind to the target and the polymerase will cause the primers to be extended along the target sequence by adding on nucleotides. By raising
5 and lowering the temperature of the reaction mixture, the extended primers will dissociate from the target to form reaction products, excess primers will bind to the target and to the reaction product and the process is repeated. Preferably reverse transcription and PCR™ amplification procedure may be performed in order to quantify the amount of mRNA amplified. Polymerase chain reaction methodologies are well
10 known in the art.

Another method for amplification is the ligase chain reaction (referred to as LCR), disclosed in Eur. Pat. Appl. Publ. No. 320,308 (specifically incorporated herein by reference in its entirety). In LCR, two complementary probe pairs are prepared, and in the presence of the target sequence, each pair will bind to opposite
15 complementary strands of the target such that they abut. In the presence of a ligase, the two probe pairs will link to form a single unit. By temperature cycling, as in PCR™, bound ligated units dissociate from the target and then serve as "target sequences" for ligation of excess probe pairs. U.S. Patent No. 4,883,750, incorporated herein by reference in its entirety, describes an alternative method of amplification similar to LCR
20 for binding probe pairs to a target sequence.

Qbeta Replicase, described in PCT Intl. Pat. Appl. Publ. No. PCT/US87/00880, incorporated herein by reference in its entirety, may also be used as still another amplification method in the present invention. In this method, a replicative sequence of RNA that has a region complementary to that of a target is added to a
25 sample in the presence of an RNA polymerase. The polymerase will copy the replicative sequence that can then be detected.

An isothermal amplification method, in which restriction endonucleases and ligases are used to achieve the amplification of target molecules that contain nucleotide 5'-[α-thio]triphosphates in one strand of a restriction site (Walker *et al.*,
30 1992, incorporated herein by reference in its entirety), may also be useful in the amplification of nucleic acids in the present invention.

Strand Displacement Amplification (SDA) is another method of carrying out isothermal amplification of nucleic acids which involves multiple rounds of strand displacement and synthesis, *i.e.* nick translation. A similar method, called Repair Chain Reaction (RCR) is another method of amplification which may be useful in the present invention and is involves annealing several probes throughout a region targeted for amplification, followed by a repair reaction in which only two of the four bases are present. The other two bases can be added as biotinylated derivatives for easy detection. A similar approach is used in SDA.

Sequences can also be detected using a cyclic probe reaction (CPR). In CPR, a probe having a 3' and 5' sequences of non-target DNA and an internal or "middle" sequence of the target protein specific RNA is hybridized to DNA which is present in a sample. Upon hybridization, the reaction is treated with RNaseH, and the products of the probe are identified as distinctive products by generating a signal that is released after digestion. The original template is annealed to another cycling probe and the reaction is repeated. Thus, CPR involves amplifying a signal generated by hybridization of a probe to a target gene specific expressed nucleic acid.

Still other amplification methods described in Great Britain Pat. Appl. No. 2 202 328, and in PCT Intl. Pat. Appl. Publ. No. PCT/US89/01025, each of which is incorporated herein by reference in its entirety, may be used in accordance with the present invention. In the former application, "modified" primers are used in a PCR-like, template and enzyme dependent synthesis. The primers may be modified by labeling with a capture moiety (*e.g.*, biotin) and/or a detector moiety (*e.g.*, enzyme). In the latter application, an excess of labeled probes is added to a sample. In the presence of the target sequence, the probe binds and is cleaved catalytically. After cleavage, the target sequence is released intact to be bound by excess probe. Cleavage of the labeled probe signals the presence of the target sequence.

Other nucleic acid amplification procedures include transcription-based amplification systems (TAS) (Kwoh *et al.*, 1989; PCT Intl. Pat. Appl. Publ. No. WO 88/10315, incorporated herein by reference in its entirety), including nucleic acid sequence based amplification (NASBA) and 3SR. In NASBA, the nucleic acids can be prepared for amplification by standard phenol/chloroform extraction, heat denaturation

of a sample, treatment with lysis buffer and minispin columns for isolation of DNA and RNA or guanidinium chloride extraction of RNA. These amplification techniques involve annealing a primer that has sequences specific to the target sequence. Following polymerization, DNA/RNA hybrids are digested with RNase H while double stranded DNA molecules are heat-denatured again. In either case the single stranded DNA is made fully double stranded by addition of second target-specific primer, followed by polymerization. The double stranded DNA molecules are then multiply transcribed by a polymerase such as T7 or SP6. In an isothermal cyclic reaction, the RNAs are reverse transcribed into DNA, and transcribed once again with a polymerase such as T7 or SP6. The resulting products, whether truncated or complete, indicate target-specific sequences.

Eur. Pat. Appl. Publ. No. 329,822, incorporated herein by reference in its entirety, disclose a nucleic acid amplification process involving cyclically synthesizing single-stranded RNA ("ssRNA"), ssDNA, and double-stranded DNA (dsDNA), which may be used in accordance with the present invention. The ssRNA is a first template for a first primer oligonucleotide, which is elongated by reverse transcriptase (RNA-dependent DNA polymerase). The RNA is then removed from resulting DNA:RNA duplex by the action of ribonuclease H (RNase H, an RNase specific for RNA in a duplex with either DNA or RNA). The resultant ssDNA is a second template for a second primer, which also includes the sequences of an RNA polymerase promoter (exemplified by T7 RNA polymerase) 5' to its homology to its template. This primer is then extended by DNA polymerase (exemplified by the large "Klenow" fragment of *E. coli* DNA polymerase I), resulting as a double-stranded DNA ("dsDNA") molecule, having a sequence identical to that of the original RNA between the primers and having additionally, at one end, a promoter sequence. This promoter sequence can be used by the appropriate RNA polymerase to make many RNA copies of the DNA. These copies can then re-enter the cycle leading to very swift amplification. With proper choice of enzymes, this amplification can be done isothermally without addition of enzymes at each cycle. Because of the cyclical nature of this process, the starting sequence can be chosen to be in the form of either DNA or RNA.

PCT Intl. Pat. Appl. Publ. No. WO 89/06700, incorporated herein by reference in its entirety, disclose a nucleic acid sequence amplification scheme based on the hybridization of a promoter/primer sequence to a target single-stranded DNA ("ssDNA") followed by transcription of many RNA copies of the sequence. This
5 scheme is not cyclic; i.e. new templates are not produced from the resultant RNA transcripts. Other amplification methods include "RACE" (Frohman, 1990), and "one-sided PCR" (Ohara, 1989) which are well-known to those of skill in the art.

Methods based on ligation of two (or more) oligonucleotides in the presence of nucleic acid having the sequence of the resulting "di-oligonucleotide",
10 thereby amplifying the di-oligonucleotide (Wu and Dean, 1996, incorporated herein by reference in its entirety), may also be used in the amplification of DNA sequences of the present invention.

BIOLOGICAL FUNCTIONAL EQUIVALENTS

Modification and changes may be made in the structure of the
15 polynucleotides and polypeptides of the present invention and still obtain a functional molecule that encodes a polypeptide with desirable characteristics. As mentioned above, it is often desirable to introduce one or more mutations into a specific polynucleotide sequence. In certain circumstances, the resulting encoded polypeptide sequence is altered by this mutation, or in other cases, the sequence of the polypeptide
20 is unchanged by one or more mutations in the encoding polynucleotide.

When it is desirable to alter the amino acid sequence of a polypeptide to create an equivalent, or even an improved, second-generation molecule, the amino acid changes may be achieved by changing one or more of the codons of the encoding DNA sequence, according to Table 1.

25 For example, certain amino acids may be substituted for other amino acids in a protein structure without appreciable loss of interactive binding capacity with structures such as, for example, antigen-binding regions of antibodies or binding sites on substrate molecules. Since it is the interactive capacity and nature of a protein that defines that protein's biological functional activity, certain amino acid sequence
30 substitutions can be made in a protein sequence, and, of course, its underlying DNA

coding sequence, and nevertheless obtain a protein with like properties. It is thus contemplated by the inventors that various changes may be made in the peptide sequences of the disclosed compositions, or corresponding DNA sequences which encode said peptides without appreciable loss of their biological utility or activity.

5

TABLE I

| Amino Acids | | | Codons | | | | | | |
|---------------|-----|---|--------|-----|-----|-----|-----|-----|--|
| Alanine | Ala | A | GCA | GCC | GCG | GCU | | | |
| Cysteine | Cys | C | UGC | UGU | | | | | |
| Aspartic acid | Asp | D | GAC | GAU | | | | | |
| Glutamic acid | Glu | E | GAA | GAG | | | | | |
| Phenylalanine | Phe | F | UUC | UUU | | | | | |
| Glycine | Gly | G | GGA | GGC | GGG | GGU | | | |
| Histidine | His | H | CAC | CAU | | | | | |
| Isoleucine | Ile | I | AUA | AUC | AUU | | | | |
| Lysine | Lys | K | AAA | AAG | | | | | |
| Leucine | Leu | L | UUA | UUG | CUA | CUC | CUG | CUU | |
| Methionine | Met | M | AUG | | | | | | |
| Asparagine | Asn | N | AAC | AAU | | | | | |
| Proline | Pro | P | CCA | CCC | CCG | CCU | | | |
| Glutamine | Gln | Q | CAA | CAG | | | | | |
| Arginine | Arg | R | AGA | AGG | CGA | CGC | CGG | CGU | |
| Serine | Ser | S | AGC | AGU | UCA | UCC | UCG | UCU | |
| Threonine | Thr | T | ACA | ACC | ACG | ACU | | | |
| Valine | Val | V | GUA | GUC | GUG | GUU | | | |
| Tryptophan | Trp | W | UGG | | | | | | |
| Tyrosine | Tyr | Y | UAC | UAU | | | | | |

In making such changes, the hydropathic index of amino acids may be considered. The importance of the hydropathic amino acid index in conferring interactive biologic function on a protein is generally understood in the art (Kyte and Doolittle, 1982, incorporated herein by reference). It is accepted that the relative

Doolittle, 1982, incorporated herein by reference). It is accepted that the relative hydrophobic character of the amino acid contributes to the secondary structure of the resultant protein, which in turn defines the interaction of the protein with other molecules, for example, enzymes, substrates, receptors, DNA, antibodies, antigens, and the like. Each amino acid has been assigned a hydrophobic index on the basis of its hydrophobicity and charge characteristics (Kyte and Doolittle, 1982). These values are: isoleucine (+4.5); valine (+4.2); leucine (+3.8); phenylalanine (+2.8); cysteine/cystine (+2.5); methionine (+1.9); alanine (+1.8); glycine (−0.4); threonine (−0.7); serine (−0.8); tryptophan (−0.9); tyrosine (−1.3); proline (−1.6); histidine (−3.2); glutamate (−3.5); glutamine (−3.5); aspartate (−3.5); asparagine (−3.5); lysine (−3.9); and arginine (−4.5).

It is known in the art that certain amino acids may be substituted by other amino acids having a similar hydrophobic index or score and still result in a protein with similar biological activity, *i.e.* still obtain a biological functionally equivalent protein. In making such changes, the substitution of amino acids whose hydrophobic indices are within ± 2 is preferred, those within ± 1 are particularly preferred, and those within ± 0.5 are even more particularly preferred. It is also understood in the art that the substitution of like amino acids can be made effectively on the basis of hydrophilicity. U. S. Patent 4,554,101 (specifically incorporated herein by reference in its entirety), states that the greatest local average hydrophilicity of a protein, as governed by the hydrophilicity of its adjacent amino acids, correlates with a biological property of the protein.

As detailed in U. S. Patent 4,554,101, the following hydrophilicity values have been assigned to amino acid residues: arginine (+3.0); lysine (+3.0); aspartate (+3.0 \pm 1); glutamate (+3.0 \pm 1); serine (+0.3); asparagine (+0.2); glutamine (+0.2); glycine (0); threonine (−0.4); proline (−0.5 \pm 1); alanine (−0.5); histidine (−0.5); cysteine (−1.0); methionine (−1.3); valine (−1.5); leucine (−1.8); isoleucine (−1.8); tyrosine (−2.3); phenylalanine (−2.5); tryptophan (−3.4). It is understood that an amino acid can be substituted for another having a similar hydrophilicity value and still obtain a biologically equivalent, and in particular, an immunologically equivalent protein. In such changes, the substitution of amino acids whose hydrophilicity values are within ± 2

is preferred, those within ± 1 are particularly preferred, and those within ± 0.5 are even more particularly preferred.

As outlined above, amino acid substitutions are generally therefore based on the relative similarity of the amino acid side-chain substituents, for example, their hydrophobicity, hydrophilicity, charge, size, and the like. Exemplary substitutions that take various of the foregoing characteristics into consideration are well known to those of skill in the art and include: arginine and lysine; glutamate and aspartate; serine and threonine; glutamine and asparagine; and valine, leucine and isoleucine.

In addition, any polynucleotide may be further modified to increase stability *in vivo*. Possible modifications include, but are not limited to, the addition of flanking sequences at the 5' and/or 3' ends; the use of phosphorothioate or 2' O-methyl rather than phosphodiesterase linkages in the backbone; and/or the inclusion of nontraditional bases such as inosine, queosine and wybutosine, as well as acetyl-methyl-, thio- and other modified forms of adenine, cytidine, guanine, thymine and uridine.

IN VIVO POLYNUCLEOTIDE DELIVERY TECHNIQUES

In additional embodiments, genetic constructs comprising one or more of the polynucleotides of the invention are introduced into cells *in vivo*. This may be achieved using any of a variety of well known approaches, several of which are outlined below for the purpose of illustration.

1. ADENOVIRUS

One of the preferred methods for *in vivo* delivery of one or more nucleic acid sequences involves the use of an adenovirus expression vector. "Adenovirus expression vector" is meant to include those constructs containing adenovirus sequences sufficient to (a) support packaging of the construct and (b) to express a polynucleotide that has been cloned therein in a sense or antisense orientation. Of course, in the context of an antisense construct, expression does not require that the gene product be synthesized.

The expression vector comprises a genetically engineered form of an adenovirus. Knowledge of the genetic organization of adenovirus, a 36 kb, linear, double-stranded DNA virus, allows substitution of large pieces of adenoviral DNA with foreign sequences up to 7 kb (Grunhaus and Horwitz, 1992). In contrast to retrovirus, the adenoviral infection of host cells does not result in chromosomal integration because adenoviral DNA can replicate in an episomal manner without potential genotoxicity. Also, adenoviruses are structurally stable, and no genome rearrangement has been detected after extensive amplification. Adenovirus can infect virtually all epithelial cells regardless of their cell cycle stage. So far, adenoviral infection appears to be linked only to mild disease such as acute respiratory disease in humans.

Adenovirus is particularly suitable for use as a gene transfer vector because of its mid-sized genome, ease of manipulation, high titer, wide target-cell range and high infectivity. Both ends of the viral genome contain 100-200 base pair inverted repeats (ITRs), which are *cis* elements necessary for viral DNA replication and packaging. The early (E) and late (L) regions of the genome contain different transcription units that are divided by the onset of viral DNA replication. The E1 region (E1A and E1B) encodes proteins responsible for the regulation of transcription of the viral genome and a few cellular genes. The expression of the E2 region (E2A and E2B) results in the synthesis of the proteins for viral DNA replication. These proteins are involved in DNA replication, late gene expression and host cell shut-off (Renan, 1990). The products of the late genes, including the majority of the viral capsid proteins, are expressed only after significant processing of a single primary transcript issued by the major late promoter (MLP). The MLP, (located at 16.8 m.u.) is particularly efficient during the late phase of infection, and all the mRNA's issued from this promoter possess a 5'-tripartite leader (TPL) sequence which makes them preferred mRNA's for translation.

In a current system, recombinant adenovirus is generated from homologous recombination between shuttle vector and provirus vector. Due to the possible recombination between two proviral vectors, wild-type adenovirus may be generated from this process. Therefore, it is critical to isolate a single clone of virus from an individual plaque and examine its genomic structure.

Generation and propagation of the current adenovirus vectors, which are replication deficient, depend on a unique helper cell line, designated 293, which was transformed from human embryonic kidney cells by Ad5 DNA fragments and constitutively expresses E1 proteins (Graham *et al.*, 1977). Since the E3 region is dispensable from the adenovirus genome (Jones and Shenk, 1978), the current adenovirus vectors, with the help of 293 cells, carry foreign DNA in either the E1, the D3 or both regions (Graham and Prevec, 1991). In nature, adenovirus can package approximately 105% of the wild-type genome (Ghosh-Choudhury *et al.*, 1987), providing capacity for about 2 extra kB of DNA. Combined with the approximately 5.5 kB of DNA that is replaceable in the E1 and E3 regions, the maximum capacity of the current adenovirus vector is under 7.5 kB, or about 15% of the total length of the vector. More than 80% of the adenovirus viral genome remains in the vector backbone and is the source of vector-borne cytotoxicity. Also, the replication deficiency of the E1-deleted virus is incomplete. For example, leakage of viral gene expression has been observed with the currently available vectors at high multiplicities of infection (MOI) (Mulligan, 1993).

Helper cell lines may be derived from human cells such as human embryonic kidney cells, muscle cells, hematopoietic cells or other human embryonic mesenchymal or epithelial cells. Alternatively, the helper cells may be derived from the cells of other mammalian species that are permissive for human adenovirus. Such cells include, *e.g.*, Vero cells or other monkey embryonic mesenchymal or epithelial cells. As stated above, the currently preferred helper cell line is 293.

Recently, Racher *et al.* (1995) disclosed improved methods for culturing 293 cells and propagating adenovirus. In one format, natural cell aggregates are grown by inoculating individual cells into 1 liter siliconized spinner flasks (Techne, Cambridge, UK) containing 100-200 ml of medium. Following stirring at 40 rpm, the cell viability is estimated with trypan blue. In another format, Fibra-Cel microcarriers (Bibby Sterlin, Stone, UK) (5 g/l) is employed as follows. A cell inoculum, resuspended in 5 ml of medium, is added to the carrier (50 ml) in a 250 ml Erlenmeyer flask and left stationary, with occasional agitation, for 1 to 4 h. The medium is then replaced with 50 ml of fresh medium and shaking initiated. For virus production, cells

are allowed to grow to about 80% confluence, after which time the medium is replaced (to 25% of the final volume) and adenovirus added at an MOI of 0.05. Cultures are left stationary overnight, following which the volume is increased to 100% and shaking commenced for another 72 h.

5 Other than the requirement that the adenovirus vector be replication defective, or at least conditionally defective, the nature of the adenovirus vector is not believed to be crucial to the successful practice of the invention. The adenovirus may be of any of the 42 different known serotypes or subgroups A-F. Adenovirus type 5 of subgroup C is the preferred starting material in order to obtain a conditional replication-
10 defective adenovirus vector for use in the present invention, since Adenovirus type 5 is a human adenovirus about which a great deal of biochemical and genetic information is known, and it has historically been used for most constructions employing adenovirus as a vector.

 As stated above, the typical vector according to the present invention is
15 replication defective and will not have an adenovirus E1 region. Thus, it will be most convenient to introduce the polynucleotide encoding the gene of interest at the position from which the E1-coding sequences have been removed. However, the position of insertion of the construct within the adenovirus sequences is not critical to the invention. The polynucleotide encoding the gene of interest may also be inserted in lieu
20 of the deleted E3 region in E3 replacement vectors as described by Karlsson *et al.* (1986) or in the E4 region where a helper cell line or helper virus complements the E4 defect.

 Adenovirus is easy to grow and manipulate and exhibits broad host range *in vitro* and *in vivo*. This group of viruses can be obtained in high titers, *e.g.*, 10^9 - 10^{11}
25 plaque-forming units per ml, and they are highly infective. The life cycle of adenovirus does not require integration into the host cell genome. The foreign genes delivered by adenovirus vectors are episomal and, therefore, have low genotoxicity to host cells. No side effects have been reported in studies of vaccination with wild-type adenovirus (Couch *et al.*, 1963; Top *et al.*, 1971), demonstrating their safety and therapeutic
30 potential as *in vivo* gene transfer vectors.

Adenovirus vectors have been used in eukaryotic gene expression (Levrero *et al.*, 1991; Gomez-Foix *et al.*, 1992) and vaccine development (Grunhaus and Horwitz, 1992; Graham and Prevec, 1992). Recently, animal studies suggested that recombinant adenovirus could be used for gene therapy (Stratford-Perricaudet and Perricaudet, 1991; Stratford-Perricaudet *et al.*, 1990; Rich *et al.*, 1993). Studies in administering recombinant adenovirus to different tissues include trachea instillation (Rosenfeld *et al.*, 1991; Rosenfeld *et al.*, 1992), muscle injection (Ragot *et al.*, 1993), peripheral intravenous injections (Herz and Gerard, 1993) and stereotactic inoculation into the brain (Le Gal La Salle *et al.*, 1993).

10 2. RETROVIRUSES

The retroviruses are a group of single-stranded RNA viruses characterized by an ability to convert their RNA to double-stranded DNA in infected cells by a process of reverse-transcription (Coffin, 1990). The resulting DNA then stably integrates into cellular chromosomes as a provirus and directs synthesis of viral proteins. The integration results in the retention of the viral gene sequences in the recipient cell and its descendants. The retroviral genome contains three genes, gag, pol, and env that code for capsid proteins, polymerase enzyme, and envelope components, respectively. A sequence found upstream from the gag gene contains a signal for packaging of the genome into virions. Two long terminal repeat (LTR) sequences are present at the 5' and 3' ends of the viral genome. These contain strong promoter and enhancer sequences and are also required for integration in the host cell genome (Coffin, 1990).

In order to construct a retroviral vector, a nucleic acid encoding one or more oligonucleotide or polynucleotide sequences of interest is inserted into the viral genome in the place of certain viral sequences to produce a virus that is replication-defective. In order to produce virions, a packaging cell line containing the gag, pol, and env genes but without the LTR and packaging components is constructed (Mann *et al.*, 1983). When a recombinant plasmid containing a cDNA, together with the retroviral LTR and packaging sequences is introduced into this cell line (by calcium phosphate precipitation for example), the packaging sequence allows the RNA transcript of the

recombinant plasmid to be packaged into viral particles, which are then secreted into the culture media (Nicolas and Rubenstein, 1988; Temin, 1986; Mann *et al.*, 1983). The media containing the recombinant retroviruses is then collected, optionally concentrated, and used for gene transfer. Retroviral vectors are able to infect a broad
5 variety of cell types. However, integration and stable expression require the division of host cells (Paskind *et al.*, 1975).

A novel approach designed to allow specific targeting of retrovirus vectors was recently developed based on the chemical modification of a retrovirus by the chemical addition of lactose residues to the viral envelope. This modification could
10 permit the specific infection of hepatocytes *via* sialoglycoprotein receptors.

A different approach to targeting of recombinant retroviruses was designed in which biotinylated antibodies against a retroviral envelope protein and against a specific cell receptor were used. The antibodies were coupled *via* the biotin components by using streptavidin (Roux *et al.*, 1989). Using antibodies against major
15 histocompatibility complex class I and class II antigens, they demonstrated the infection of a variety of human cells that bore those surface antigens with an ecotropic virus *in vitro* (Roux *et al.*, 1989).

3. ADENO-ASSOCIATED VIRUSES

AAV (Ridgeway, 1988; Hermonat and Muzyczka, 1984) is a parovirus,
20 discovered as a contamination of adenoviral stocks. It is a ubiquitous virus (antibodies are present in 85% of the US human population) that has not been linked to any disease. It is also classified as a dependovirus, because its replications is dependent on the presence of a helper virus, such as adenovirus. Five serotypes have been isolated, of which AAV-2 is the best characterized. AAV has a single-stranded linear DNA that is
25 encapsidated into capsid proteins VP1, VP2 and VP3 to form an icosahedral virion of 20 to 24 nm in diameter (Muzyczka and McLaughlin, 1988).

The AAV DNA is approximately 4.7 kilobases long. It contains two open reading frames and is flanked by two ITRs. There are two major genes in the AAV genome: *rep* and *cap*. The *rep* gene codes for proteins responsible for viral
30 replications, whereas *cap* codes for capsid protein VP1-3. Each ITR forms a T-shaped

hairpin structure. These terminal repeats are the only essential *cis* components of the AAV for chromosomal integration. Therefore, the AAV can be used as a vector with all viral coding sequences removed and replaced by the cassette of genes for delivery. Three viral promoters have been identified and named p5, p19, and p40, according to
5 their map position. Transcription from p5 and p19 results in production of rep proteins, and transcription from p40 produces the capsid proteins (Hermonat and Muzyczka, 1984).

There are several factors that prompted researchers to study the possibility of using rAAV as an expression vector. One is that the requirements for
10 delivering a gene to integrate into the host chromosome are surprisingly few. It is necessary to have the 145-bp ITRs, which are only 6% of the AAV genome. This leaves room in the vector to assemble a 4.5-kb DNA insertion. While this carrying capacity may prevent the AAV from delivering large genes, it is amply suited for delivering the antisense constructs of the present invention.

15 AAV is also a good choice of delivery vehicles due to its safety. There is a relatively complicated rescue mechanism: not only wild type adenovirus but also AAV genes are required to mobilize rAAV. Likewise, AAV is not pathogenic and not associated with any disease. The removal of viral coding sequences minimizes immune reactions to viral gene expression, and therefore, rAAV does not evoke an inflammatory
20 response.

4. OTHER VIRAL VECTORS AS EXPRESSION CONSTRUCTS

Other viral vectors may be employed as expression constructs in the present invention for the delivery of oligonucleotide or polynucleotide sequences to a host cell. Vectors derived from viruses such as vaccinia virus (Ridgeway, 1988; Coupar
25 *et al.*, 1988), lentiviruses, polio viruses and herpes viruses may be employed. They offer several attractive features for various mammalian cells (Friedmann, 1989; Ridgeway, 1988; Coupar *et al.*, 1988; Horwich *et al.*, 1990).

With the recent recognition of defective hepatitis B viruses, new insight was gained into the structure-function relationship of different viral sequences. *In vitro*
30 studies showed that the virus could retain the ability for helper-dependent packaging

and reverse transcription despite the deletion of up to 80% of its genome (Horwich *et al.*, 1990). This suggested that large portions of the genome could be replaced with foreign genetic material. The hepatotropism and persistence (integration) were particularly attractive properties for liver-directed gene transfer. Chang *et al.* (1991) introduced the chloramphenicol acetyltransferase (CAT) gene into duck hepatitis B virus genome in the place of the polymerase, surface, and pre-surface coding sequences. It was cotransfected with wild-type virus into an avian hepatoma cell line. Culture media containing high titers of the recombinant virus were used to infect primary duckling hepatocytes. Stable CAT gene expression was detected for at least 24 days after transfection (Chang *et al.*, 1991).

5. NON-VIRAL VECTORS

In order to effect expression of the oligonucleotide or polynucleotide sequences of the present invention, the expression construct must be delivered into a cell. This delivery may be accomplished *in vitro*, as in laboratory procedures for transforming cells lines, or *in vivo* or *ex vivo*, as in the treatment of certain disease states. As described above, one preferred mechanism for delivery is *via* viral infection where the expression construct is encapsulated in an infectious viral particle.

Once the expression construct has been delivered into the cell the nucleic acid encoding the desired oligonucleotide or polynucleotide sequences may be positioned and expressed at different sites. In certain embodiments, the nucleic acid encoding the construct may be stably integrated into the genome of the cell. This integration may be in the specific location and orientation *via* homologous recombination (gene replacement) or it may be integrated in a random, non-specific location (gene augmentation). In yet further embodiments, the nucleic acid may be stably maintained in the cell as a separate, episomal segment of DNA. Such nucleic acid segments or "episomes" encode sequences sufficient to permit maintenance and replication independent of or in synchronization with the host cell cycle. How the expression construct is delivered to a cell and where in the cell the nucleic acid remains is dependent on the type of expression construct employed.

In certain embodiments of the invention, the expression construct comprising one or more oligonucleotide or polynucleotide sequences may simply consist of naked recombinant DNA or plasmids. Transfer of the construct may be performed by any of the methods mentioned above which physically or chemically permeabilize the cell membrane. This is particularly applicable for transfer *in vitro* but it may be applied to *in vivo* use as well. Dubensky *et al.* (1984) successfully injected polyomavirus DNA in the form of calcium phosphate precipitates into liver and spleen of adult and newborn mice demonstrating active viral replication and acute infection. Benvenisty and Reshef (1986) also demonstrated that direct intraperitoneal injection of calcium phosphate-precipitated plasmids results in expression of the transfected genes. It is envisioned that DNA encoding a gene of interest may also be transferred in a similar manner *in vivo* and express the gene product.

Another embodiment of the invention for transferring a naked DNA expression construct into cells may involve particle bombardment. This method depends on the ability to accelerate DNA-coated microprojectiles to a high velocity allowing them to pierce cell membranes and enter cells without killing them (Klein *et al.*, 1987). Several devices for accelerating small particles have been developed. One such device relies on a high voltage discharge to generate an electrical current, which in turn provides the motive force (Yang *et al.*, 1990). The microprojectiles used have consisted of biologically inert substances such as tungsten or gold beads.

Selected organs including the liver, skin, and muscle tissue of rats and mice have been bombarded *in vivo* (Yang *et al.*, 1990; Zelenin *et al.*, 1991). This may require surgical exposure of the tissue or cells, to eliminate any intervening tissue between the gun and the target organ, *i.e.* *ex vivo* treatment. Again, DNA encoding a particular gene may be delivered *via* this method and still be incorporated by the present invention.

ANTISENSE OLIGONUCLEOTIDES

The end result of the flow of genetic information is the synthesis of protein. DNA is transcribed by polymerases into messenger RNA and translated on the ribosome to yield a folded, functional protein. Thus there are several steps along the

route where protein synthesis can be inhibited. The native DNA segment coding for a polypeptide described herein, as all such mammalian DNA strands, has two strands: a sense strand and an antisense strand held together by hydrogen bonding. The messenger RNA coding for polypeptide has the same nucleotide sequence as the sense
5 DNA strand except that the DNA thymidine is replaced by uridine. Thus, synthetic antisense nucleotide sequences will bind to a mRNA and inhibit expression of the protein encoded by that mRNA.

The targeting of antisense oligonucleotides to mRNA is thus one mechanism to shut down protein synthesis, and, consequently, represents a powerful
10 and targeted therapeutic approach. For example, the synthesis of polygalacturonase and the muscarine type 2 acetylcholine receptor are inhibited by antisense oligonucleotides directed to their respective mRNA sequences (U. S. Patent 5,739,119 and U. S. Patent 5,759,829, each specifically incorporated herein by reference in its entirety). Further, examples of antisense inhibition have been demonstrated with the
15 nuclear protein cyclin, the multiple drug resistance gene (MDG1), ICAM-1, E-selectin, STK-1, striatal GABA_A receptor and human EGF (Jaskulski *et al.*, 1988; Vasanthakumar and Ahmed, 1989; Peris *et al.*, 1998; U. S. Patent 5,801,154; U. S. Patent 5,789,573; U. S. Patent 5,718,709 and U. S. Patent 5,610,288, each specifically incorporated herein by reference in its entirety). Antisense constructs have also been
20 described that inhibit and can be used to treat a variety of abnormal cellular proliferations, *e.g.* cancer (U. S. Patent 5,747,470; U. S. Patent 5,591,317 and U. S. Patent 5,783,683, each specifically incorporated herein by reference in its entirety).

Therefore, in exemplary embodiments, the invention provides oligonucleotide sequences that comprise all, or a portion of, any sequence that is
25 capable of specifically binding to polynucleotide sequence described herein, or a complement thereof. In one embodiment, the antisense oligonucleotides comprise DNA or derivatives thereof. In another embodiment, the oligonucleotides comprise RNA or derivatives thereof. In a third embodiment, the oligonucleotides are modified DNAs comprising a phosphorothioated modified backbone. In a fourth embodiment, the
30 oligonucleotide sequences comprise peptide nucleic acids or derivatives thereof. In each case, preferred compositions comprise a sequence region that is complementary,

and more preferably substantially-complementary, and even more preferably, completely complementary to one or more portions of polynucleotides disclosed herein.

Selection of antisense compositions specific for a given gene sequence is based upon analysis of the chosen target sequence (*i.e.* in these illustrative examples the
5 rat and human sequences) and determination of secondary structure, T_m , binding energy, relative stability, and antisense compositions were selected based upon their relative inability to form dimers, hairpins, or other secondary structures that would reduce or prohibit specific binding to the target mRNA in a host cell.

Highly preferred target regions of the mRNA, are those which are at or
10 near the AUG translation initiation codon, and those sequences which were substantially complementary to 5' regions of the mRNA. These secondary structure analyses and target site selection considerations were performed using v.4 of the OLIGO primer analysis software (Rychlik, 1997) and the BLASTN 2.0.5 algorithm software (Altschul *et al.*, 1997).

15 The use of an antisense delivery method employing a short peptide vector, termed MPG (27 residues), is also contemplated. The MPG peptide contains a hydrophobic domain derived from the fusion sequence of HIV gp41 and a hydrophilic domain from the nuclear localization sequence of SV40 T-antigen (Morris *et al.*, 1997). It has been demonstrated that several molecules of the MPG peptide coat the antisense
20 oligonucleotides and can be delivered into cultured mammalian cells in less than 1 hour with relatively high efficiency (90%). Further, the interaction with MPG strongly increases both the stability of the oligonucleotide to nuclease and the ability to cross the plasma membrane (Morris *et al.*, 1997).

RIBOZYMES

25 Although proteins traditionally have been used for catalysis of nucleic acids, another class of macromolecules has emerged as useful in this endeavor. Ribozymes are RNA-protein complexes that cleave nucleic acids in a site-specific fashion. Ribozymes have specific catalytic domains that possess endonuclease activity (Kim and Cech, 1987; Gerlach *et al.*, 1987; Forster and Symons, 1987). For example, a
30 large number of ribozymes accelerate phosphoester transfer reactions with a high degree

of specificity, often cleaving only one of several phosphoesters in an oligonucleotide substrate (Cech *et al.*, 1981; Michel and Westhof, 1990; Reinhold-Hurek and Shub, 1992). This specificity has been attributed to the requirement that the substrate bind via specific base-pairing interactions to the internal guide sequence ("IGS") of the ribozyme
5 prior to chemical reaction.

Ribozyme catalysis has primarily been observed as part of sequence-specific cleavage/ligation reactions involving nucleic acids (Joyce, 1989; Cech *et al.*, 1981). For example, U. S. Patent No. 5,354,855 (specifically incorporated herein by reference) reports that certain ribozymes can act as endonucleases with a sequence
10 specificity greater than that of known ribonucleases and approaching that of the DNA restriction enzymes. Thus, sequence-specific ribozyme-mediated inhibition of gene expression may be particularly suited to therapeutic applications (Scanlon *et al.*, 1991; Sarver *et al.*, 1990). Recently, it was reported that ribozymes elicited genetic changes in some cells lines to which they were applied; the altered genes included the oncogenes
15 H-*ras*, c-*fos* and genes of HIV. Most of this work involved the modification of a target mRNA, based on a specific mutant codon that is cleaved by a specific ribozyme.

Six basic varieties of naturally-occurring enzymatic RNAs are known presently. Each can catalyze the hydrolysis of RNA phosphodiester bonds *in trans* (and thus can cleave other RNA molecules) under physiological conditions. In general,
20 enzymatic nucleic acids act by first binding to a target RNA. Such binding occurs through the target binding portion of a enzymatic nucleic acid which is held in close proximity to an enzymatic portion of the molecule that acts to cleave the target RNA. Thus, the enzymatic nucleic acid first recognizes and then binds a target RNA through complementary base-pairing, and once bound to the correct site, acts enzymatically to
25 cut the target RNA. Strategic cleavage of such a target RNA will destroy its ability to direct synthesis of an encoded protein. After an enzymatic nucleic acid has bound and cleaved its RNA target, it is released from that RNA to search for another target and can repeatedly bind and cleave new targets.

The enzymatic nature of a ribozyme is advantageous over many
30 technologies, such as antisense technology (where a nucleic acid molecule simply binds to a nucleic acid target to block its translation) since the concentration of ribozyme

necessary to affect a therapeutic treatment is lower than that of an antisense oligonucleotide. This advantage reflects the ability of the ribozyme to act enzymatically. Thus, a single ribozyme molecule is able to cleave many molecules of target RNA. In addition, the ribozyme is a highly specific inhibitor, with the specificity
5 of inhibition depending not only on the base pairing mechanism of binding to the target RNA, but also on the mechanism of target RNA cleavage. Single mismatches, or base-substitutions, near the site of cleavage can completely eliminate catalytic activity of a ribozyme. Similar mismatches in antisense molecules do not prevent their action (Woolf *et al.*, 1992). Thus, the specificity of action of a ribozyme is greater than that of
10 an antisense oligonucleotide binding the same RNA site.

The enzymatic nucleic acid molecule may be formed in a hammerhead, hairpin, a hepatitis δ virus, group I intron or RNaseP RNA (in association with an RNA guide sequence) or Neurospora VS RNA motif. Examples of hammerhead motifs are described by Rossi *et al.* (1992). Examples of hairpin motifs are described by Hampel
15 *et al.* (Eur. Pat. Appl. Publ. No. EP 0360257), Hampel and Tritz (1989), Hampel *et al.* (1990) and U. S. Patent 5,631,359 (specifically incorporated herein by reference). An example of the hepatitis δ virus motif is described by Perrotta and Been (1992); an example of the RNaseP motif is described by Guerrier-Takada *et al.* (1983); Neurospora VS RNA ribozyme motif is described by Collins (Saville and Collins, 1990; Saville and
20 Collins, 1991; Collins and Olive, 1993); and an example of the Group I intron is described in (U. S. Patent 4,987,071, specifically incorporated herein by reference). All that is important in an enzymatic nucleic acid molecule of this invention is that it has a specific substrate binding site which is complementary to one or more of the target gene RNA regions, and that it have nucleotide sequences within or surrounding that substrate
25 binding site which impart an RNA cleaving activity to the molecule. Thus the ribozyme constructs need not be limited to specific motifs mentioned herein.

In certain embodiments, it may be important to produce enzymatic cleaving agents which exhibit a high degree of specificity for the RNA of a desired target, such as one of the sequences disclosed herein. The enzymatic nucleic acid
30 molecule is preferably targeted to a highly conserved sequence region of a target mRNA. Such enzymatic nucleic acid molecules can be delivered exogenously to

specific cells as required. Alternatively, the ribozymes can be expressed from DNA or RNA vectors that are delivered to specific cells.

Small enzymatic nucleic acid motifs (*e.g.*, of the hammerhead or the hairpin structure) may also be used for exogenous delivery. The simple structure of these molecules increases the ability of the enzymatic nucleic acid to invade targeted regions of the mRNA structure. Alternatively, catalytic RNA molecules can be expressed within cells from eukaryotic promoters (*e.g.*, Scanlon *et al.*, 1991; Kashani-Sabet *et al.*, 1992; Dropulic *et al.*, 1992; Weerasinghe *et al.*, 1991; Ojwang *et al.*, 1992; Chen *et al.*, 1992; Sarver *et al.*, 1990). Those skilled in the art realize that any ribozyme can be expressed in eukaryotic cells from the appropriate DNA vector. The activity of such ribozymes can be augmented by their release from the primary transcript by a second ribozyme (Int. Pat. Appl. Publ. No. WO 93/23569, and Int. Pat. Appl. Publ. No. WO 94/02595, both hereby incorporated by reference; Ohkawa *et al.*, 1992; Taira *et al.*, 1991; and Ventura *et al.*, 1993).

Ribozymes may be added directly, or can be complexed with cationic lipids, lipid complexes, packaged within liposomes, or otherwise delivered to target cells. The RNA or RNA complexes can be locally administered to relevant tissues *ex vivo*, or *in vivo* through injection, aerosol inhalation, infusion pump or stent, with or without their incorporation in biopolymers.

Ribozymes may be designed as described in Int. Pat. Appl. Publ. No. WO 93/23569 and Int. Pat. Appl. Publ. No. WO 94/02595, each specifically incorporated herein by reference) and synthesized to be tested *in vitro* and *in vivo*, as described. Such ribozymes can also be optimized for delivery. While specific examples are provided, those in the art will recognize that equivalent RNA targets in other species can be utilized when necessary.

Hammerhead or hairpin ribozymes may be individually analyzed by computer folding (Jaeger *et al.*, 1989) to assess whether the ribozyme sequences fold into the appropriate secondary structure. Those ribozymes with unfavorable intramolecular interactions between the binding arms and the catalytic core are eliminated from consideration. Varying binding arm lengths can be chosen to optimize

activity. Generally, at least 5 or so bases on each arm are able to bind to, or otherwise interact with, the target RNA.

Ribozymes of the hammerhead or hairpin motif may be designed to anneal to various sites in the mRNA message, and can be chemically synthesized. The method of synthesis used follows the procedure for normal RNA synthesis as described in Usman *et al.* (1987) and in Scaringe *et al.* (1990) and makes use of common nucleic acid protecting and coupling groups, such as dimethoxytrityl at the 5'-end, and phosphoramidites at the 3'-end. Average stepwise coupling yields are typically >98%. Hairpin ribozymes may be synthesized in two parts and annealed to reconstruct an active ribozyme (Chowrira and Burke, 1992). Ribozymes may be modified extensively to enhance stability by modification with nuclease resistant groups, for example, 2'-amino, 2'-C-allyl, 2'-fluoro, 2'-o-methyl, 2'-H (for a review see *e.g.*, Usman and Cedergren, 1992). Ribozymes may be purified by gel electrophoresis using general methods or by high pressure liquid chromatography and resuspended in water.

Ribozyme activity can be optimized by altering the length of the ribozyme binding arms, or chemically synthesizing ribozymes with modifications that prevent their degradation by serum ribonucleases (see *e.g.*, Int. Pat. Appl. Publ. No. WO 92/07065; Perrault *et al.*, 1990; Pieken *et al.*, 1991; Usman and Cedergren, 1992; Int. Pat. Appl. Publ. No. WO 93/15187; Int. Pat. Appl. Publ. No. WO 91/03162; Eur. Pat. Appl. Publ. No. 92110298.4; U. S. Patent 5,334,711; and Int. Pat. Appl. Publ. No. WO 94/13688, which describe various chemical modifications that can be made to the sugar moieties of enzymatic RNA molecules), modifications which enhance their efficacy in cells, and removal of stem II bases to shorten RNA synthesis times and reduce chemical requirements.

Sullivan *et al.* (Int. Pat. Appl. Publ. No. WO 94/02595) describes the general methods for delivery of enzymatic RNA molecules. Ribozymes may be administered to cells by a variety of methods known to those familiar to the art, including, but not restricted to, encapsulation in liposomes, by iontophoresis, or by incorporation into other vehicles, such as hydrogels, cyclodextrins, biodegradable nanocapsules, and bioadhesive microspheres. For some indications, ribozymes may be directly delivered *ex vivo* to cells or tissues with or without the aforementioned vehicles.

Alternatively, the RNA/vehicle combination may be locally delivered by direct inhalation, by direct injection or by use of a catheter, infusion pump or stent. Other routes of delivery include, but are not limited to, intravascular, intramuscular, subcutaneous or joint injection, aerosol inhalation, oral (tablet or pill form), topical,
5 systemic, ocular, intraperitoneal and/or intrathecal delivery. More detailed descriptions of ribozyme delivery and administration are provided in Int. Pat. Appl. Publ. No. WO 94/02595 and Int. Pat. Appl. Publ. No. WO 93/23569, each specifically incorporated herein by reference.

Another means of accumulating high concentrations of a ribozyme(s)
10 within cells is to incorporate the ribozyme-encoding sequences into a DNA expression vector. Transcription of the ribozyme sequences are driven from a promoter for eukaryotic RNA polymerase I (pol I), RNA polymerase II (pol II), or RNA polymerase III (pol III). Transcripts from pol II or pol III promoters will be expressed at high levels in all cells; the levels of a given pol II promoter in a given cell type will depend on the
15 nature of the gene regulatory sequences (enhancers, silencers, *etc.*) present nearby. Prokaryotic RNA polymerase promoters may also be used, providing that the prokaryotic RNA polymerase enzyme is expressed in the appropriate cells (Elroy-Stein and Moss, 1990; Gao and Huang, 1993; Lieber *et al.*, 1993; Zhou *et al.*, 1990). Ribozymes expressed from such promoters can function in mammalian cells (*e.g.*
20 Kashani-Saber *et al.*, 1992; Ojwang *et al.*, 1992; Chen *et al.*, 1992; Yu *et al.*, 1993; L'Huillier *et al.*, 1992; Lisiewicz *et al.*, 1993). Such transcription units can be incorporated into a variety of vectors for introduction into mammalian cells, including but not restricted to, plasmid DNA vectors, viral DNA vectors (such as adenovirus or adeno-associated vectors), or viral RNA vectors (such as retroviral, semliki forest virus,
25 sindbis virus vectors).

Ribozymes may be used as diagnostic tools to examine genetic drift and mutations within diseased cells. They can also be used to assess levels of the target RNA molecule. The close relationship between ribozyme activity and the structure of the target RNA allows the detection of mutations in any region of the molecule which
30 alters the base-pairing and three-dimensional structure of the target RNA. By using multiple ribozymes, one may map nucleotide changes which are important to RNA

structure and function *in vitro*, as well as in cells and tissues. Cleavage of target RNAs with ribozymes may be used to inhibit gene expression and define the role (essentially) of specified gene products in the progression of disease. In this manner, other genetic targets may be defined as important mediators of the disease. These studies will lead to
5 better treatment of the disease progression by affording the possibility of combinational therapies (*e.g.*, multiple ribozymes targeted to different genes, ribozymes coupled with known small molecule inhibitors, or intermittent treatment with combinations of ribozymes and/or other chemical or biological molecules). Other *in vitro* uses of ribozymes are well known in the art, and include detection of the presence of mRNA
10 associated with an IL-5 related condition. Such RNA is detected by determining the presence of a cleavage product after treatment with a ribozyme using standard methodology.

PEPTIDE NUCLEIC ACIDS

In certain embodiments, the inventors contemplate the use of peptide
15 nucleic acids (PNAs) in the practice of the methods of the invention. PNA is a DNA mimic in which the nucleobases are attached to a pseudopeptide backbone (Good and Nielsen, 1997). PNA is able to be utilized in a number methods that traditionally have used RNA or DNA. Often PNA sequences perform better in techniques than the corresponding RNA or DNA sequences and have utilities that are not inherent to RNA
20 or DNA. A review of PNA including methods of making, characteristics of, and methods of using, is provided by Corey (1997) and is incorporated herein by reference. As such, in certain embodiments, one may prepare PNA sequences that are complementary to one or more portions of the ACE mRNA sequence, and such PNA compositions may be used to regulate, alter, decrease, or reduce the translation of ACE-
25 specific mRNA, and thereby alter the level of ACE activity in a host cell to which such PNA compositions have been administered.

PNAs have 2-aminoethyl-glycine linkages replacing the normal phosphodiester backbone of DNA (Nielsen *et al.*, 1991; Hanvey *et al.*, 1992; Hyrup and Nielsen, 1996; Neilsen, 1996). This chemistry has three important consequences:
30 firstly, in contrast to DNA or phosphorothioate oligonucleotides, PNAs are neutral

molecules; secondly, PNAs are achiral, which avoids the need to develop a stereoselective synthesis; and thirdly, PNA synthesis uses standard Boc (Dueholm *et al.*, 1994) or Fmoc (Thomson *et al.*, 1995) protocols for solid-phase peptide synthesis, although other methods, including a modified Merrifield method, have been used
5 (Christensen *et al.*, 1995).

PNA monomers or ready-made oligomers are commercially available from PerSeptive Biosystems (Framingham, MA). PNA syntheses by either Boc or Fmoc protocols are straightforward using manual or automated protocols (Norton *et al.*, 1995). The manual protocol lends itself to the production of chemically modified PNAs
10 or the simultaneous synthesis of families of closely related PNAs.

As with peptide synthesis, the success of a particular PNA synthesis will depend on the properties of the chosen sequence. For example, while in theory PNAs can incorporate any combination of nucleotide bases, the presence of adjacent purines can lead to deletions of one or more residues in the product. In expectation of this
15 difficulty, it is suggested that, in producing PNAs with adjacent purines, one should repeat the coupling of residues likely to be added inefficiently. This should be followed by the purification of PNAs by reverse-phase high-pressure liquid chromatography (Norton *et al.*, 1995) providing yields and purity of product similar to those observed during the synthesis of peptides.

20 Modifications of PNAs for a given application may be accomplished by coupling amino acids during solid-phase synthesis or by attaching compounds that contain a carboxylic acid group to the exposed N-terminal amine. Alternatively, PNAs can be modified after synthesis by coupling to an introduced lysine or cysteine. The ease with which PNAs can be modified facilitates optimization for better solubility or
25 for specific functional requirements. Once synthesized, the identity of PNAs and their derivatives can be confirmed by mass spectrometry. Several studies have made and utilized modifications of PNAs (Norton *et al.*, 1995; Haaime *et al.*, 1996; Stetsenko *et al.*, 1996; Petersen *et al.*, 1995; Ulmann *et al.*, 1996; Koch *et al.*, 1995; Orum *et al.*, 1995; Footer *et al.*, 1996; Griffith *et al.*, 1995; Kremsky *et al.*, 1996; Pardridge *et al.*,
30 1995; Boffa *et al.*, 1995; Landsdorp *et al.*, 1996; Gambacorti-Passerini *et al.*, 1996; Armitage *et al.*, 1997; Seeger *et al.*, 1997; Ruskowski *et al.*, 1997). U.S. Patent No.

5,700,922 discusses PNA-DNA-PNA chimeric molecules and their uses in diagnostics, modulating protein in organisms, and treatment of conditions susceptible to therapeutics.

In contrast to DNA and RNA, which contain negatively charged linkages, the PNA backbone is neutral. In spite of this dramatic alteration, PNAs recognize complementary DNA and RNA by Watson-Crick pairing (Egholm *et al.*, 1993), validating the initial modeling by Nielsen *et al.* (1991). PNAs lack 3' to 5' polarity and can bind in either parallel or antiparallel fashion, with the antiparallel mode being preferred (Egholm *et al.*, 1993).

Hybridization of DNA oligonucleotides to DNA and RNA is destabilized by electrostatic repulsion between the negatively charged phosphate backbones of the complementary strands. By contrast, the absence of charge repulsion in PNA-DNA or PNA-RNA duplexes increases the melting temperature (T_m) and reduces the dependence of T_m on the concentration of mono- or divalent cations (Nielsen *et al.*, 1991). The enhanced rate and affinity of hybridization are significant because they are responsible for the surprising ability of PNAs to perform strand invasion of complementary sequences within relaxed double-stranded DNA. In addition, the efficient hybridization at inverted repeats suggests that PNAs can recognize secondary structure effectively within double-stranded DNA. Enhanced recognition also occurs with PNAs immobilized on surfaces, and Wang *et al.* have shown that support-bound PNAs can be used to detect hybridization events (Wang *et al.*, 1996).

One might expect that tight binding of PNAs to complementary sequences would also increase binding to similar (but not identical) sequences, reducing the sequence specificity of PNA recognition. As with DNA hybridization, however, selective recognition can be achieved by balancing oligomer length and incubation temperature. Moreover, selective hybridization of PNAs is encouraged by PNA-DNA hybridization being less tolerant of base mismatches than DNA-DNA hybridization. For example, a single mismatch within a 16 bp PNA-DNA duplex can reduce the T_m by up to 15°C (Egholm *et al.*, 1993). This high level of discrimination has allowed the development of several PNA-based strategies for the analysis of point mutations (Wang

et al., 1996; Carlsson *et al.*, 1996; Thiede *et al.*, 1996; Webb and Hurskainen, 1996; Perry-O'Keefe *et al.*, 1996).

High-affinity binding provides clear advantages for molecular recognition and the development of new applications for PNAs. For example, 11-13 nucleotide PNAs inhibit the activity of telomerase, a ribonucleo-protein that extends telomere ends using an essential RNA template, while the analogous DNA oligomers do not (Norton *et al.*, 1996).

Neutral PNAs are more hydrophobic than analogous DNA oligomers, and this can lead to difficulty solubilizing them at neutral pH, especially if the PNAs have a high purine content or if they have the potential to form secondary structures. Their solubility can be enhanced by attaching one or more positive charges to the PNA termini (Nielsen *et al.*, 1991).

Findings by Allfrey and colleagues suggest that strand invasion will occur spontaneously at sequences within chromosomal DNA (Boffa *et al.*, 1995; Boffa *et al.*, 1996). These studies targeted PNAs to triplet repeats of the nucleotides CAG and used this recognition to purify transcriptionally active DNA (Boffa *et al.*, 1995) and to inhibit transcription (Boffa *et al.*, 1996). This result suggests that if PNAs can be delivered within cells then they will have the potential to be general sequence-specific regulators of gene expression. Studies and reviews concerning the use of PNAs as antisense and anti-gene agents include Nielsen *et al.* (1993b), Hanvey *et al.* (1992), and Good and Nielsen (1997). Koppelhus *et al.* (1997) have used PNAs to inhibit HIV-1 inverse transcription, showing that PNAs may be used for antiviral therapies.

Methods of characterizing the antisense binding properties of PNAs are discussed in Rose (1993) and Jensen *et al.* (1997). Rose uses capillary gel electrophoresis to determine binding of PNAs to their complementary oligonucleotide, measuring the relative binding kinetics and stoichiometry. Similar types of measurements were made by Jensen *et al.* using BIAcore™ technology.

Other applications of PNAs include use in DNA strand invasion (Nielsen *et al.*, 1991), antisense inhibition (Hanvey *et al.*, 1992), mutational analysis (Orum *et al.*, 1993), enhancers of transcription (Mollegaard *et al.*, 1994), nucleic acid purification (Orum *et al.*, 1995), isolation of transcriptionally active genes (Boffa *et al.*, 1995),

blocking of transcription factor binding (Vickers *et al.*, 1995), genome cleavage (Veselkov *et al.*, 1996), biosensors (Wang *et al.*, 1996), *in situ* hybridization (Thisted *et al.*, 1996), and in a alternative to Southern blotting (Perry-O'Keefe, 1996).

POLYPEPTIDE COMPOSITIONS

5 The present invention, in other aspects, provides polypeptide compositions. Generally, a polypeptide of the invention will be an isolated polypeptide (or an epitope, variant, or active fragment thereof) derived from a mammalian species. Preferably, the polypeptide is encoded by a polynucleotide sequence disclosed herein or a sequence which hybridizes under moderately stringent conditions to a polynucleotide
10 sequence disclosed herein. Alternatively, the polypeptide may be defined as a polypeptide which comprises a contiguous amino acid sequence from an amino acid sequence disclosed herein, or which polypeptide comprises an entire amino acid sequence disclosed herein.

 In the present invention, a polypeptide composition is also understood to
15 comprise one or more polypeptides that are immunologically reactive with antibodies generated against a polypeptide of the invention, or to active fragments, or to variants or biological functional equivalents thereof.

 Likewise, a polypeptide composition of the present invention is understood to comprise one or more polypeptides that are capable of eliciting antibodies
20 that are immunologically reactive with one or more polypeptides encoded by one or more contiguous nucleic acid sequences contained in SEQ ID NO: 1-38, 42-204, 205, 207 and 210-290, or to active fragments, or to variants thereof, or to one or more nucleic acid sequences which hybridize to one or more of these sequences under conditions of moderate to high stringency.

25 As used herein, an active fragment of a polypeptide includes a whole or a portion of a polypeptide which is modified by conventional techniques, *e.g.*, mutagenesis, or by addition, deletion, or substitution, but which active fragment exhibits substantially the same structure function, antigenicity, etc., as a polypeptide as described herein.

In certain illustrative embodiments, the polypeptides of the invention will comprise at least an immunogenic portion of a breast tumor protein or a variant thereof, as described herein. As noted above, a "breast tumor protein" is a protein that is expressed by breast tumor cells. Proteins that are breast tumor proteins react
5 detectably within an immunoassay (such as an ELISA) with antisera from a patient with breast cancer. Polypeptides as described herein may be of any length. Additional sequences derived from the native protein and/or heterologous sequences may be present, and such sequences may (but need not) possess further immunogenic or antigenic properties.

10 An "immunogenic portion," as used herein is a portion of a protein that is recognized (*i.e.*, specifically bound) by a B-cell and/or T-cell surface antigen receptor. Such immunogenic portions generally comprise at least 5 amino acid residues, more preferably at least 10, and still more preferably at least 20 amino acid residues of a breast tumor protein or a variant thereof. Certain preferred immunogenic
15 portions include peptides in which an N-terminal leader sequence and/or transmembrane domain have been deleted. Other preferred immunogenic portions may contain a small N- and/or C-terminal deletion (*e.g.*, 1-30 amino acids, preferably 5-15 amino acids), relative to the mature protein.

Immunogenic portions may generally be identified using well known
20 techniques, such as those summarized in Paul, *Fundamental Immunology*, 3rd ed., 243-247 (Raven Press, 1993) and references cited therein. Such techniques include screening polypeptides for the ability to react with antigen-specific antibodies, antisera and/or T-cell lines or clones. As used herein, antisera and antibodies are "antigen-specific" if they specifically bind to an antigen (*i.e.*, they react with the protein in an
25 ELISA or other immunoassay, and do not react detectably with unrelated proteins). Such antisera and antibodies may be prepared as described herein, and using well known techniques. An immunogenic portion of a native breast tumor protein is a portion that reacts with such antisera and/or T-cells at a level that is not substantially less than the reactivity of the full length polypeptide (*e.g.*, in an ELISA and/or T-cell
30 reactivity assay). Such immunogenic portions may react within such assays at a level that is similar to or greater than the reactivity of the full length polypeptide. Such

5 screens may generally be performed using methods well known to those of ordinary skill in the art, such as those described in Harlow and Lane, *Antibodies: A Laboratory Manual*, Cold Spring Harbor Laboratory, 1988. For example, a polypeptide may be immobilized on a solid support and contacted with patient sera to allow binding of antibodies within the sera to the immobilized polypeptide. Unbound sera may then be removed and bound antibodies detected using, for example, ¹²⁵I-labeled Protein A.

As noted above, a composition may comprise a variant of a native breast tumor protein. A polypeptide "variant," as used herein, is a polypeptide that differs from a native breast tumor protein in one or more substitutions, deletions, additions and/or insertions, such that the immunogenicity of the polypeptide is not substantially diminished. In other words, the ability of a variant to react with antigen-specific antisera may be enhanced or unchanged, relative to the native protein, or may be diminished by less than 50%, and preferably less than 20%, relative to the native protein. Such variants may generally be identified by modifying one of the above polypeptide sequences and evaluating the reactivity of the modified polypeptide with antigen-specific antibodies or antisera as described herein. Preferred variants include those in which one or more portions, such as an N-terminal leader sequence or transmembrane domain, have been removed. Other preferred variants include variants in which a small portion (e.g., 1-30 amino acids, preferably 5-15 amino acids) has been removed from the N- and/or C-terminal of the mature protein.

Polypeptide variants encompassed by the present invention include those exhibiting at least about 70%, 75%, 80%, 85%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, or 99% or more identity (determined as described above) to the polypeptides disclosed herein.

25 Preferably, a variant contains conservative substitutions. A "conservative substitution" is one in which an amino acid is substituted for another amino acid that has similar properties, such that one skilled in the art of peptide chemistry would expect the secondary structure and hydrophobic nature of the polypeptide to be substantially unchanged. Amino acid substitutions may generally be made on the basis of similarity in polarity, charge, solubility, hydrophobicity, hydrophilicity and/or the amphipathic nature of the residues. For example, negatively

- charged amino acids include aspartic acid and glutamic acid; positively charged amino acids include lysine and arginine; and amino acids with uncharged polar head groups having similar hydrophilicity values include leucine, isoleucine and valine; glycine and alanine; asparagine and glutamine; and serine, threonine, phenylalanine and tyrosine.
- 5 Other groups of amino acids that may represent conservative changes include: (1) ala, pro, gly, glu, asp, gln, asn, ser, thr; (2) cys, ser, tyr, thr; (3) val, ile, leu, met, ala, phe; (4) lys, arg, his; and (5) phe, tyr, trp, his. A variant may also, or alternatively, contain nonconservative changes. In a preferred embodiment, variant polypeptides differ from a native sequence by substitution, deletion or addition of five amino acids or fewer.
- 10 Variants may also (or alternatively) be modified by, for example, the deletion or addition of amino acids that have minimal influence on the immunogenicity, secondary structure and hydropathic nature of the polypeptide.

As noted above, polypeptides may comprise a signal (or leader) sequence at the N-terminal end of the protein, which co-translationally or post-translationally directs transfer of the protein. The polypeptide may also be conjugated to a linker or other sequence for ease of synthesis, purification or identification of the polypeptide (*e.g.*, poly-His), or to enhance binding of the polypeptide to a solid support. For example, a polypeptide may be conjugated to an immunoglobulin Fc region.

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Polypeptides may be prepared using any of a variety of well known techniques. Recombinant polypeptides encoded by DNA sequences as described above may be readily prepared from the DNA sequences using any of a variety of expression vectors known to those of ordinary skill in the art. Expression may be achieved in any appropriate host cell that has been transformed or transfected with an expression vector containing a DNA molecule that encodes a recombinant polypeptide. Suitable host cells include prokaryotes, yeast, and higher eukaryotic cells, such as mammalian cells and plant cells. Preferably, the host cells employed are *E. coli*, yeast or a mammalian cell line such as COS or CHO. Supernatants from suitable host/vector systems which secrete recombinant protein or polypeptide into culture media may be first concentrated using a commercially available filter. Following concentration, the concentrate may be applied to a suitable purification matrix such as an affinity matrix or an ion exchange

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resin. Finally, one or more reverse phase HPLC steps can be employed to further purify a recombinant polypeptide.

Portions and other variants having less than about 100 amino acids, and generally less than about 50 amino acids, may also be generated by synthetic means, using techniques well known to those of ordinary skill in the art. For example, such polypeptides may be synthesized using any of the commercially available solid-phase techniques, such as the Merrifield solid-phase synthesis method, where amino acids are sequentially added to a growing amino acid chain. See Merrifield, *J. Am. Chem. Soc.* 85:2149-2146, 1963. Equipment for automated synthesis of polypeptides is commercially available from suppliers such as Perkin Elmer/Applied BioSystems Division (Foster City, CA), and may be operated according to the manufacturer's instructions.

Within certain specific embodiments, a polypeptide may be a fusion protein that comprises multiple polypeptides as described herein, or that comprises at least one polypeptide as described herein and an unrelated sequence, such as a known tumor protein. A fusion partner may, for example, assist in providing T helper epitopes (an immunological fusion partner), preferably T helper epitopes recognized by humans, or may assist in expressing the protein (an expression enhancer) at higher yields than the native recombinant protein. Certain preferred fusion partners are both immunological and expression enhancing fusion partners. Other fusion partners may be selected so as to increase the solubility of the protein or to enable the protein to be targeted to desired intracellular compartments. Still further fusion partners include affinity tags, which facilitate purification of the protein.

Fusion proteins may generally be prepared using standard techniques, including chemical conjugation. Preferably, a fusion protein is expressed as a recombinant protein, allowing the production of increased levels, relative to a non-fused protein, in an expression system. Briefly, DNA sequences encoding the polypeptide components may be assembled separately, and ligated into an appropriate expression vector. The 3' end of the DNA sequence encoding one polypeptide component is ligated, with or without a peptide linker, to the 5' end of a DNA sequence encoding the second polypeptide component so that the reading frames of the sequences are in phase.

This permits translation into a single fusion protein that retains the biological activity of both component polypeptides.

A peptide linker sequence may be employed to separate the first and second polypeptide components by a distance sufficient to ensure that each polypeptide
5 folds into its secondary and tertiary structures. Such a peptide linker sequence is incorporated into the fusion protein using standard techniques well known in the art. Suitable peptide linker sequences may be chosen based on the following factors: (1) their ability to adopt a flexible extended conformation; (2) their inability to adopt a secondary structure that could interact with functional epitopes on the first and second
10 polypeptides; and (3) the lack of hydrophobic or charged residues that might react with the polypeptide functional epitopes. Preferred peptide linker sequences contain Gly, Asn and Ser residues. Other near neutral amino acids, such as Thr and Ala may also be used in the linker sequence. Amino acid sequences which may be usefully employed as linkers include those disclosed in Maratea et al., *Gene* 40:39-46, 1985; Murphy et al.,
15 *Proc. Natl. Acad. Sci. USA* 83:8258-8262, 1986; U.S. Patent No. 4,935,233 and U.S. Patent No. 4,751,180. The linker sequence may generally be from 1 to about 50 amino acids in length. Linker sequences are not required when the first and second polypeptides have non-essential N-terminal amino acid regions that can be used to separate the functional domains and prevent steric interference.

20 The ligated DNA sequences are operably linked to suitable transcriptional or translational regulatory elements. The regulatory elements responsible for expression of DNA are located only 5' to the DNA sequence encoding the first polypeptides. Similarly, stop codons required to end translation and transcription termination signals are only present 3' to the DNA sequence encoding the
25 second polypeptide.

Fusion proteins are also provided. Such proteins comprise a polypeptide as described herein together with an unrelated immunogenic protein. Preferably the immunogenic protein is capable of eliciting a recall response. Examples of such proteins include tetanus, tuberculosis and hepatitis proteins (*see, for example, Stoute et al. New Engl. J. Med.*, 336:86-91, 1997).
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Within preferred embodiments, an immunological fusion partner is derived from protein D, a surface protein of the gram-negative bacterium *Haemophilus influenza B* (WO 91/18926). Preferably, a protein D derivative comprises approximately the first third of the protein (e.g., the first N-terminal 100-110 amino acids), and a protein D derivative may be lipidated. Within certain preferred
5 embodiments, the first 109 residues of a Lipoprotein D fusion partner is included on the N-terminus to provide the polypeptide with additional exogenous T-cell epitopes and to increase the expression level in *E. coli* (thus functioning as an expression enhancer). The lipid tail ensures optimal presentation of the antigen to antigen presenting cells.
10 Other fusion partners include the non-structural protein from influenzae virus, NS1 (hemagglutinin). Typically, the N-terminal 81 amino acids are used, although different fragments that include T-helper epitopes may be used.

In another embodiment, the immunological fusion partner is the protein known as LYTA, or a portion thereof (preferably a C-terminal portion). LYTA is
15 derived from *Streptococcus pneumoniae*, which synthesizes an N-acetyl-L-alanine amidase known as amidase LYTA (encoded by the *LytA* gene; *Gene* 43:265-292, 1986). LYTA is an autolysin that specifically degrades certain bonds in the peptidoglycan backbone. The C-terminal domain of the LYTA protein is responsible for the affinity to the choline or to some choline analogues such as DEAE. This
20 property has been exploited for the development of *E. coli* C-LYTA expressing plasmids useful for expression of fusion proteins. Purification of hybrid proteins containing the C-LYTA fragment at the amino terminus has been described (see *Biotechnology* 10:795-798, 1992). Within a preferred embodiment, a repeat portion of LYTA may be incorporated into a fusion protein. A repeat portion is found in the C-
25 terminal region starting at residue 178. A particularly preferred repeat portion incorporates residues 188-305.

In general, polypeptides (including fusion proteins) and polynucleotides as described herein are isolated. An "isolated" polypeptide or polynucleotide is one that is removed from its original environment. For example, a naturally-occurring protein is
30 isolated if it is separated from some or all of the coexisting materials in the natural system. Preferably, such polypeptides are at least about 90% pure, more preferably at

least about 95% pure and most preferably at least about 99% pure. A polynucleotide is considered to be isolated if, for example, it is cloned into a vector that is not a part of the natural environment.

BINDING AGENTS

5 The present invention further provides agents, such as antibodies and antigen-binding fragments thereof, that specifically bind to a breast tumor protein. As used herein, an antibody, or antigen-binding fragment thereof, is said to "specifically bind" to a breast tumor protein if it reacts at a detectable level (within, for example, an ELISA) with a breast tumor protein, and does not react detectably with unrelated
10 proteins under similar conditions. As used herein, "binding" refers to a noncovalent association between two separate molecules such that a complex is formed. The ability to bind may be evaluated by, for example, determining a binding constant for the formation of the complex. The binding constant is the value obtained when the concentration of the complex is divided by the product of the component
15 concentrations. In general, two compounds are said to "bind," in the context of the present invention, when the binding constant for complex formation exceeds about 10^3 L/mol. The binding constant may be determined using methods well known in the art.

Binding agents may be further capable of differentiating between patients with and without a cancer, such as breast cancer, using the representative assays
20 provided herein. In other words, antibodies or other binding agents that bind to a breast tumor protein will generate a signal indicating the presence of a cancer in at least about 20% of patients with the disease, and will generate a negative signal indicating the absence of the disease in at least about 90% of individuals without the cancer. To determine whether a binding agent satisfies this requirement, biological samples (*e.g.*,
25 blood, sera, sputum, urine and/or tumor biopsies) from patients with and without a cancer (as determined using standard clinical tests) may be assayed as described herein for the presence of polypeptides that bind to the binding agent. It will be apparent that a statistically significant number of samples with and without the disease should be assayed. Each binding agent should satisfy the above criteria; however, those of

ordinary skill in the art will recognize that binding agents may be used in combination to improve sensitivity.

Any agent that satisfies the above requirements may be a binding agent. For example, a binding agent may be a ribosome, with or without a peptide component, an RNA molecule or a polypeptide. In a preferred embodiment, a binding agent is an antibody or an antigen-binding fragment thereof. Antibodies may be prepared by any of a variety of techniques known to those of ordinary skill in the art. *See, e.g.,* Harlow and Lane, *Antibodies: A Laboratory Manual*, Cold Spring Harbor Laboratory, 1988. In general, antibodies can be produced by cell culture techniques, including the generation of monoclonal antibodies as described herein, or via transfection of antibody genes into suitable bacterial or mammalian cell hosts, in order to allow for the production of recombinant antibodies. In one technique, an immunogen comprising the polypeptide is initially injected into any of a wide variety of mammals (*e.g.,* mice, rats, rabbits, sheep or goats). In this step, the polypeptides of this invention may serve as the immunogen without modification. Alternatively, particularly for relatively short polypeptides, a superior immune response may be elicited if the polypeptide is joined to a carrier protein, such as bovine serum albumin or keyhole limpet hemocyanin. The immunogen is injected into the animal host, preferably according to a predetermined schedule incorporating one or more booster immunizations, and the animals are bled periodically. Polyclonal antibodies specific for the polypeptide may then be purified from such antisera by, for example, affinity chromatography using the polypeptide coupled to a suitable solid support.

Monoclonal antibodies specific for an antigenic polypeptide of interest may be prepared, for example, using the technique of Kohler and Milstein, *Eur. J. Immunol.* 6:511-519, 1976, and improvements thereto. Briefly, these methods involve the preparation of immortal cell lines capable of producing antibodies having the desired specificity (*i.e.,* reactivity with the polypeptide of interest). Such cell lines may be produced, for example, from spleen cells obtained from an animal immunized as described above. The spleen cells are then immortalized by, for example, fusion with a myeloma cell fusion partner, preferably one that is syngeneic with the immunized animal. A variety of fusion techniques may be employed. For example, the spleen cells

and myeloma cells may be combined with a nonionic detergent for a few minutes and then plated at low density on a selective medium that supports the growth of hybrid cells, but not myeloma cells. A preferred selection technique uses HAT (hypoxanthine, aminopterin, thymidine) selection. After a sufficient time, usually about 1 to 2 weeks,
5 colonies of hybrids are observed. Single colonies are selected and their culture supernatants tested for binding activity against the polypeptide. Hybridomas having high reactivity and specificity are preferred.

Monoclonal antibodies may be isolated from the supernatants of growing hybridoma colonies. In addition, various techniques may be employed to enhance the
10 yield, such as injection of the hybridoma cell line into the peritoneal cavity of a suitable vertebrate host, such as a mouse. Monoclonal antibodies may then be harvested from the ascites fluid or the blood. Contaminants may be removed from the antibodies by conventional techniques, such as chromatography, gel filtration, precipitation, and extraction. The polypeptides of this invention may be used in the purification process
15 in, for example, an affinity chromatography step.

Within certain embodiments, the use of antigen-binding fragments of antibodies may be preferred. Such fragments include Fab fragments, which may be prepared using standard techniques. Briefly, immunoglobulins may be purified from rabbit serum by affinity chromatography on Protein A bead columns (Harlow and Lane,
20 *Antibodies: A Laboratory Manual*, Cold Spring Harbor Laboratory, 1988) and digested by papain to yield Fab and Fc fragments. The Fab and Fc fragments may be separated by affinity chromatography on protein A bead columns.

Monoclonal antibodies of the present invention may be coupled to one or more therapeutic agents. Suitable agents in this regard include radionuclides,
25 differentiation inducers, drugs, toxins, and derivatives thereof. Preferred radionuclides include ^{90}Y , ^{123}I , ^{125}I , ^{131}I , ^{186}Re , ^{188}Re , ^{211}At , and ^{212}Bi . Preferred drugs include methotrexate, and pyrimidine and purine analogs. Preferred differentiation inducers include phorbol esters and butyric acid. Preferred toxins include ricin, abrin, diphtheria toxin, cholera toxin, gelonin, *Pseudomonas* exotoxin, *Shigella* toxin, and pokeweed
30 antiviral protein.

A therapeutic agent may be coupled (*e.g.*, covalently bonded) to a suitable monoclonal antibody either directly or indirectly (*e.g.*, via a linker group). A direct reaction between an agent and an antibody is possible when each possesses a substituent capable of reacting with the other. For example, a nucleophilic group, such as an amino or sulfhydryl group, on one may be capable of reacting with a carbonyl-containing group, such as an anhydride or an acid halide, or with an alkyl group containing a good leaving group (*e.g.*, a halide) on the other.

Alternatively, it may be desirable to couple a therapeutic agent and an antibody via a linker group. A linker group can function as a spacer to distance an antibody from an agent in order to avoid interference with binding capabilities. A linker group can also serve to increase the chemical reactivity of a substituent on an agent or an antibody, and thus increase the coupling efficiency. An increase in chemical reactivity may also facilitate the use of agents, or functional groups on agents, which otherwise would not be possible.

It will be evident to those skilled in the art that a variety of bifunctional or polyfunctional reagents, both homo- and hetero-functional (such as those described in the catalog of the Pierce Chemical Co., Rockford, IL), may be employed as the linker group. Coupling may be effected, for example, through amino groups, carboxyl groups, sulfhydryl groups or oxidized carbohydrate residues. There are numerous references describing such methodology, *e.g.*, U.S. Patent No. 4,671,958, to Rodwell et al.

Where a therapeutic agent is more potent when free from the antibody portion of the immunoconjugates of the present invention, it may be desirable to use a linker group which is cleavable during or upon internalization into a cell. A number of different cleavable linker groups have been described. The mechanisms for the intracellular release of an agent from these linker groups include cleavage by reduction of a disulfide bond (*e.g.*, U.S. Patent No. 4,489,710, to Spitler), by irradiation of a photolabile bond (*e.g.*, U.S. Patent No. 4,625,014, to Senter et al.), by hydrolysis of derivatized amino acid side chains (*e.g.*, U.S. Patent No. 4,638,045, to Kohn et al.), by serum complement-mediated hydrolysis (*e.g.*, U.S. Patent No. 4,671,958, to Rodwell et al.), and acid-catalyzed hydrolysis (*e.g.*, U.S. Patent No. 4,569,789, to Blattler et al.).

It may be desirable to couple more than one agent to an antibody. In one embodiment, multiple molecules of an agent are coupled to one antibody molecule. In another embodiment, more than one type of agent may be coupled to one antibody. Regardless of the particular embodiment, immunoconjugates with more than one agent
5 may be prepared in a variety of ways. For example, more than one agent may be coupled directly to an antibody molecule, or linkers that provide multiple sites for attachment can be used. Alternatively, a carrier can be used.

A carrier may bear the agents in a variety of ways, including covalent bonding either directly or via a linker group. Suitable carriers include proteins such as
10 albumins (*e.g.*, U.S. Patent No. 4,507,234, to Kato et al.), peptides and polysaccharides such as aminodextran (*e.g.*, U.S. Patent No. 4,699,784, to Shih et al.). A carrier may also bear an agent by noncovalent bonding or by encapsulation, such as within a liposome vesicle (*e.g.*, U.S. Patent Nos. 4,429,008 and 4,873,088). Carriers specific for radionuclide agents include radiohalogenated small molecules and chelating
15 compounds. For example, U.S. Patent No. 4,735,792 discloses representative radiohalogenated small molecules and their synthesis. A radionuclide chelate may be formed from chelating compounds that include those containing nitrogen and sulfur atoms as the donor atoms for binding the metal, or metal oxide, radionuclide. For example, U.S. Patent No. 4,673,562, to Davison et al. discloses representative chelating
20 compounds and their synthesis.

A variety of routes of administration for the antibodies and immunoconjugates may be used. Typically, administration will be intravenous, intramuscular, subcutaneous or in the bed of a resected tumor. It will be evident that the precise dose of the antibody/immunoconjugate will vary depending upon the antibody
25 used, the antigen density on the tumor, and the rate of clearance of the antibody.

T CELLS

Immunotherapeutic compositions may also, or alternatively, comprise T cells specific for a breast tumor protein. Such cells may generally be prepared *in vitro* or *ex vivo*, using standard procedures. For example, T cells may be isolated from bone
30 marrow, peripheral blood, or a fraction of bone marrow or peripheral blood of a patient,

using a commercially available cell separation system, such as the Isolex™ System, available from Nexell Therapeutics, Inc. (Irvine, CA; see also U.S. Patent No. 5,240,856; U.S. Patent No. 5,215,926; WO 89/06280; WO 91/16116 and WO 92/07243). Alternatively, T cells may be derived from related or unrelated humans,
5 non-human mammals, cell lines or cultures.

T cells may be stimulated with a breast tumor polypeptide, polynucleotide encoding a breast tumor polypeptide and/or an antigen presenting cell (APC) that expresses such a polypeptide. Such stimulation is performed under conditions and for a time sufficient to permit the generation of T cells that are specific
10 for the polypeptide. Preferably, a breast tumor polypeptide or polynucleotide is present within a delivery vehicle, such as a microsphere, to facilitate the generation of specific T cells.

T cells are considered to be specific for a breast tumor polypeptide if the T cells specifically proliferate, secrete cytokines or kill target cells coated with the polypeptide or expressing a gene encoding the polypeptide. T cell specificity may be
15 evaluated using any of a variety of standard techniques. For example, within a chromium release assay or proliferation assay, a stimulation index of more than two fold increase in lysis and/or proliferation, compared to negative controls, indicates T cell specificity. Such assays may be performed, for example, as described in Chen et al., *Cancer Res.* 54:1065-1070, 1994. Alternatively, detection of the proliferation of
20 T cells may be accomplished by a variety of known techniques. For example, T cell proliferation can be detected by measuring an increased rate of DNA synthesis (*e.g.*, by pulse-labeling cultures of T cells with tritiated thymidine and measuring the amount of tritiated thymidine incorporated into DNA). Contact with a breast tumor polypeptide
25 (100 ng/ml - 100 µg/ml, preferably 200 ng/ml - 25 µg/ml) for 3 - 7 days should result in at least a two fold increase in proliferation of the T cells. Contact as described above for 2-3 hours should result in activation of the T cells, as measured using standard cytokine assays in which a two fold increase in the level of cytokine release (*e.g.*, TNF or IFN-γ) is indicative of T cell activation (*see* Coligan et al., *Current Protocols in*
30 *Immunology*, vol. 1, Wiley Interscience (Greene 1998)). T cells that have been activated in response to a breast tumor polypeptide, polynucleotide or polypeptide-

expressing APC may be CD4⁺ and/or CD8⁺. Breast tumor protein-specific T cells may be expanded using standard techniques. Within preferred embodiments, the T cells are derived from a patient, a related donor or an unrelated donor, and are administered to the patient following stimulation and expansion.

5 For therapeutic purposes, CD4⁺ or CD8⁺ T cells that proliferate in response to a breast tumor polypeptide, polynucleotide or APC can be expanded in number either *in vitro* or *in vivo*. Proliferation of such T cells *in vitro* may be accomplished in a variety of ways. For example, the T cells can be re-exposed to a breast tumor polypeptide, or a short peptide corresponding to an immunogenic portion
10 of such a polypeptide, with or without the addition of T cell growth factors, such as interleukin-2, and/or stimulator cells that synthesize a breast tumor polypeptide. Alternatively, one or more T cells that proliferate in the presence of a breast tumor protein can be expanded in number by cloning. Methods for cloning cells are well known in the art, and include limiting dilution.

15 **PHARMACEUTICAL COMPOSITIONS**

In additional embodiments, the present invention concerns formulation of one or more of the polynucleotide, polypeptide, T-cell and/or antibody compositions disclosed herein in pharmaceutically-acceptable solutions for administration to a cell or an animal, either alone, or in combination with one or more other modalities of therapy.

20 It will also be understood that, if desired, the nucleic acid segment, RNA, DNA or PNA compositions that express a polypeptide as disclosed herein may be administered in combination with other agents as well, such as, *e.g.*, other proteins or polypeptides or various pharmaceutically-active agents. In fact, there is virtually no limit to other components that may also be included, given that the additional agents do
25 not cause a significant adverse effect upon contact with the target cells or host tissues. The compositions may thus be delivered along with various other agents as required in the particular instance. Such compositions may be purified from host cells or other biological sources, or alternatively may be chemically synthesized as described herein. Likewise, such compositions may further comprise substituted or derivatized RNA or
30 DNA compositions.

Formulation of pharmaceutically-acceptable excipients and carrier solutions is well-known to those of skill in the art, as is the development of suitable dosing and treatment regimens for using the particular compositions described herein in a variety of treatment regimens, including *e.g.*, oral, parenteral, intravenous, intranasal, and intramuscular administration and formulation.

1. ORAL DELIVERY

In certain applications, the pharmaceutical compositions disclosed herein may be delivered *via* oral administration to an animal. As such, these compositions may be formulated with an inert diluent or with an assimilable edible carrier, or they may be enclosed in hard- or soft-shell gelatin capsule, or they may be compressed into tablets, or they may be incorporated directly with the food of the diet.

The active compounds may even be incorporated with excipients and used in the form of ingestible tablets, buccal tables, troches, capsules, elixirs, suspensions, syrups, wafers, and the like (Mathiowitz *et al.*, 1997; Hwang *et al.*, 1998; U. S. Patent 5,641,515; U. S. Patent 5,580,579 and U. S. Patent 5,792,451, each specifically incorporated herein by reference in its entirety). The tablets, troches, pills, capsules and the like may also contain the following: a binder, as gum tragacanth, acacia, cornstarch, or gelatin; excipients, such as dicalcium phosphate; a disintegrating agent, such as corn starch, potato starch, alginic acid and the like; a lubricant, such as magnesium stearate; and a sweetening agent, such as sucrose, lactose or saccharin may be added or a flavoring agent, such as peppermint, oil of wintergreen, or cherry flavoring. When the dosage unit form is a capsule, it may contain, in addition to materials of the above type, a liquid carrier. Various other materials may be present as coatings or to otherwise modify the physical form of the dosage unit. For instance, tablets, pills, or capsules may be coated with shellac, sugar, or both. A syrup or elixir may contain the active compound sucrose as a sweetening agent methyl and propylparabens as preservatives, a dye and flavoring, such as cherry or orange flavor. Of course, any material used in preparing any dosage unit form should be pharmaceutically pure and substantially non-toxic in the amounts employed. In

addition, the active compounds may be incorporated into sustained-release preparation and formulations.

Typically, these formulations may contain at least about 0.1% of the active compound or more, although the percentage of the active ingredient(s) may, of course, be varied and may conveniently be between about 1 or 2% and about 60% or 70% or more of the weight or volume of the total formulation. Naturally, the amount of active compound(s) in each therapeutically useful composition may be prepared in such a way that a suitable dosage will be obtained in any given unit dose of the compound. Factors such as solubility, bioavailability, biological half-life, route of administration, product shelf life, as well as other pharmacological considerations will be contemplated by one skilled in the art of preparing such pharmaceutical formulations, and as such, a variety of dosages and treatment regimens may be desirable.

For oral administration the compositions of the present invention may alternatively be incorporated with one or more excipients in the form of a mouthwash, dentifrice, buccal tablet, oral spray, or sublingual orally-administered formulation. For example, a mouthwash may be prepared incorporating the active ingredient in the required amount in an appropriate solvent, such as a sodium borate solution (Dobell's Solution). Alternatively, the active ingredient may be incorporated into an oral solution such as one containing sodium borate, glycerin and potassium bicarbonate, or dispersed in a dentifrice, or added in a therapeutically-effective amount to a composition that may include water, binders, abrasives, flavoring agents, foaming agents, and humectants. Alternatively the compositions may be fashioned into a tablet or solution form that may be placed under the tongue or otherwise dissolved in the mouth.

2. INJECTABLE DELIVERY

In certain circumstances it will be desirable to deliver the pharmaceutical compositions disclosed herein parenterally, intravenously, intramuscularly, or even intraperitoneally as described in U. S. Patent 5,543,158; U. S. Patent 5,641,515 and U. S. Patent 5,399,363 (each specifically incorporated herein by reference in its entirety). Solutions of the active compounds as free base or pharmacologically acceptable salts may be prepared in water suitably mixed with a surfactant, such as

hydroxypropylcellulose. Dispersions may also be prepared in glycerol, liquid polyethylene glycols, and mixtures thereof and in oils. Under ordinary conditions of storage and use, these preparations contain a preservative to prevent the growth of microorganisms.

5 The pharmaceutical forms suitable for injectable use include sterile aqueous solutions or dispersions and sterile powders for the extemporaneous preparation of sterile injectable solutions or dispersions (U. S. Patent 5,466,468, specifically incorporated herein by reference in its entirety). In all cases the form must be sterile and must be fluid to the extent that easy syringability exists. It must be stable
10 under the conditions of manufacture and storage and must be preserved against the contaminating action of microorganisms, such as bacteria and fungi. The carrier can be a solvent or dispersion medium containing, for example, water, ethanol, polyol (*e.g.*, glycerol, propylene glycol, and liquid polyethylene glycol, and the like), suitable mixtures thereof, and/or vegetable oils. Proper fluidity may be maintained, for
15 example, by the use of a coating, such as lecithin, by the maintenance of the required particle size in the case of dispersion and by the use of surfactants. The prevention of the action of microorganisms can be facilitated by various antibacterial and antifungal agents, for example, parabens, chlorobutanol, phenol, sorbic acid, thimerosal, and the like. In many cases, it will be preferable to include isotonic agents, for example, sugars
20 or sodium chloride. Prolonged absorption of the injectable compositions can be brought about by the use in the compositions of agents delaying absorption, for example, aluminum monostearate and gelatin.

 For parenteral administration in an aqueous solution, for example, the solution should be suitably buffered if necessary and the liquid diluent first rendered
25 isotonic with sufficient saline or glucose. These particular aqueous solutions are especially suitable for intravenous, intramuscular, subcutaneous and intraperitoneal administration. In this connection, a sterile aqueous medium that can be employed will be known to those of skill in the art in light of the present disclosure. For example, one dosage may be dissolved in 1 ml of isotonic NaCl solution and either added to 1000 ml
30 of hypodermoclysis fluid or injected at the proposed site of infusion, (see for example, "Remington's Pharmaceutical Sciences" 15th Edition, pages 1035-1038 and 1570-

1580). Some variation in dosage will necessarily occur depending on the condition of the subject being treated. The person responsible for administration will, in any event, determine the appropriate dose for the individual subject. Moreover, for human administration, preparations should meet sterility, pyrogenicity, and the general safety
5 and purity standards as required by FDA Office of Biologics standards.

Sterile injectable solutions are prepared by incorporating the active compounds in the required amount in the appropriate solvent with various of the other ingredients enumerated above, as required, followed by filtered sterilization. Generally, dispersions are prepared by incorporating the various sterilized active ingredients into a
10 sterile vehicle which contains the basic dispersion medium and the required other ingredients from those enumerated above. In the case of sterile powders for the preparation of sterile injectable solutions, the preferred methods of preparation are vacuum-drying and freeze-drying techniques which yield a powder of the active ingredient plus any additional desired ingredient from a previously sterile-filtered
15 solution thereof.

The compositions disclosed herein may be formulated in a neutral or salt form. Pharmaceutically-acceptable salts, include the acid addition salts (formed with the free amino groups of the protein) and which are formed with inorganic acids such as, for example, hydrochloric or phosphoric acids, or such organic acids as acetic,
20 oxalic, tartaric, mandelic, and the like. Salts formed with the free carboxyl groups can also be derived from inorganic bases such as, for example, sodium, potassium, ammonium, calcium, or ferric hydroxides, and such organic bases as isopropylamine, trimethylamine, histidine, procaine and the like. Upon formulation, solutions will be administered in a manner compatible with the dosage formulation and in such amount
25 as is therapeutically effective. The formulations are easily administered in a variety of dosage forms such as injectable solutions, drug-release capsules, and the like.

As used herein, "carrier" includes any and all solvents, dispersion media, vehicles, coatings, diluents, antibacterial and antifungal agents, isotonic and absorption delaying agents, buffers, carrier solutions, suspensions, colloids, and the like. The use
30 of such media and agents for pharmaceutical active substances is well known in the art. Except insofar as any conventional media or agent is incompatible with the active

ingredient, its use in the therapeutic compositions is contemplated. Supplementary active ingredients can also be incorporated into the compositions.

The phrase "pharmaceutically-acceptable" refers to molecular entities and compositions that do not produce an allergic or similar untoward reaction when administered to a human. The preparation of an aqueous composition that contains a protein as an active ingredient is well understood in the art. Typically, such compositions are prepared as injectables, either as liquid solutions or suspensions; solid forms suitable for solution in, or suspension in, liquid prior to injection can also be prepared. The preparation can also be emulsified.

10 3. NASAL DELIVERY

In certain embodiments, the pharmaceutical compositions may be delivered by intranasal sprays, inhalation, and/or other aerosol delivery vehicles. Methods for delivering genes, nucleic acids, and peptide compositions directly to the lungs *via* nasal aerosol sprays has been described *e.g.*, in U. S. Patent 5,756,353 and U. S. Patent 5,804,212 (each specifically incorporated herein by reference in its entirety). Likewise, the delivery of drugs using intranasal microparticle resins (Takenaga *et al.*, 1998) and lysophosphatidyl-glycerol compounds (U. S. Patent 5,725,871, specifically incorporated herein by reference in its entirety) are also well-known in the pharmaceutical arts. Likewise, transmucosal drug delivery in the form of a polytetrafluoroethylene support matrix is described in U. S. Patent 5,780,045 (specifically incorporated herein by reference in its entirety).

4. LIPOSOME-, NANOCAPSULE-, AND MICROPARTICLE-MEDIATED DELIVERY

In certain embodiments, the inventors contemplate the use of liposomes, nanocapsules, microparticles, microspheres, lipid particles, vesicles, and the like, for the introduction of the compositions of the present invention into suitable host cells. In particular, the compositions of the present invention may be formulated for delivery either encapsulated in a lipid particle, a liposome, a vesicle, a nanosphere, or a nanoparticle or the like.

Such formulations may be preferred for the introduction of pharmaceutically-acceptable formulations of the nucleic acids or constructs disclosed herein. The formation and use of liposomes is generally known to those of skill in the art (see for example, Couvreur *et al.*, 1977; Couvreur, 1988; Lasic, 1998; which
5 describes the use of liposomes and nanocapsules in the targeted antibiotic therapy for intracellular bacterial infections and diseases). Recently, liposomes were developed with improved serum stability and circulation half-times (Gabizon and Papahadjopoulos, 1988; Allen and Choun, 1987; U. S. Patent 5,741,516, specifically incorporated herein by reference in its entirety). Further, various methods of liposome
10 and liposome like preparations as potential drug carriers have been reviewed (Takakura, 1998; Chandran *et al.*, 1997; Margalit, 1995; U. S. Patent 5,567,434; U. S. Patent 5,552,157; U. S. Patent 5,565,213; U. S. Patent 5,738,868 and U. S. Patent 5,795,587, each specifically incorporated herein by reference in its entirety).

Liposomes have been used successfully with a number of cell types that
15 are normally resistant to transfection by other procedures including T cell suspensions, primary hepatocyte cultures and PC 12 cells (Renneisen *et al.*, 1990; Muller *et al.*, 1990). In addition, liposomes are free of the DNA length constraints that are typical of viral-based delivery systems. Liposomes have been used effectively to introduce genes, drugs (Heath and Martin, 1986; Heath *et al.*, 1986; Balazsovits *et al.*, 1989; Fresta and
20 Puglisi, 1996), radiotherapeutic agents (Pikul *et al.*, 1987), enzymes (Imaizumi *et al.*, 1990a; Imaizumi *et al.*, 1990b), viruses (Faller and Baltimore, 1984), transcription factors and allosteric effectors (Nicolau and Gersonde, 1979) into a variety of cultured cell lines and animals. In addition, several successful clinical trials examining the effectiveness of liposome-mediated drug delivery have been completed (Lopez-
25 Berestein *et al.*, 1985a; 1985b; Coune, 1988; Sculier *et al.*, 1988). Furthermore, several studies suggest that the use of liposomes is not associated with autoimmune responses, toxicity or gonadal localization after systemic delivery (Mori and Fukatsu, 1992).

Liposomes are formed from phospholipids that are dispersed in an aqueous medium and spontaneously form multilamellar concentric bilayer vesicles (also
30 termed multilamellar vesicles (MLVs). MLVs generally have diameters of from 25 nm to 4 μ m. Sonication of MLVs results in the formation of small unilamellar vesicles

(SUVs) with diameters in the range of 200 to 500 Å, containing an aqueous solution in the core.

Liposomes bear resemblance to cellular membranes and are contemplated for use in connection with the present invention as carriers for the peptide compositions. They are widely suitable as both water- and lipid-soluble substances can be entrapped, *i.e.* in the aqueous spaces and within the bilayer itself, respectively. It is possible that the drug-bearing liposomes may even be employed for site-specific delivery of active agents by selectively modifying the liposomal formulation.

In addition to the teachings of Couvreur *et al.* (1977; 1988), the following information may be utilized in generating liposomal formulations. Phospholipids can form a variety of structures other than liposomes when dispersed in water, depending on the molar ratio of lipid to water. At low ratios the liposome is the preferred structure. The physical characteristics of liposomes depend on pH, ionic strength and the presence of divalent cations. Liposomes can show low permeability to ionic and polar substances, but at elevated temperatures undergo a phase transition which markedly alters their permeability. The phase transition involves a change from a closely packed, ordered structure, known as the gel state, to a loosely packed, less-ordered structure, known as the fluid state. This occurs at a characteristic phase-transition temperature and results in an increase in permeability to ions, sugars and drugs.

In addition to temperature, exposure to proteins can alter the permeability of liposomes. Certain soluble proteins, such as cytochrome c, bind, deform and penetrate the bilayer, thereby causing changes in permeability. Cholesterol inhibits this penetration of proteins, apparently by packing the phospholipids more tightly. It is contemplated that the most useful liposome formations for antibiotic and inhibitor delivery will contain cholesterol.

The ability to trap solutes varies between different types of liposomes. For example, MLVs are moderately efficient at trapping solutes, but SUVs are extremely inefficient. SUVs offer the advantage of homogeneity and reproducibility in size distribution, however, and a compromise between size and trapping efficiency is

offered by large unilamellar vesicles (LUVs). These are prepared by ether evaporation and are three to four times more efficient at solute entrapment than MLVs.

In addition to liposome characteristics, an important determinant in entrapping compounds is the physicochemical properties of the compound itself. Polar
5 compounds are trapped in the aqueous spaces and nonpolar compounds bind to the lipid bilayer of the vesicle. Polar compounds are released through permeation or when the bilayer is broken, but nonpolar compounds remain affiliated with the bilayer unless it is disrupted by temperature or exposure to lipoproteins. Both types show maximum efflux rates at the phase transition temperature.

10 Liposomes interact with cells *via* four different mechanisms: endocytosis by phagocytic cells of the reticuloendothelial system such as macrophages and neutrophils; adsorption to the cell surface, either by nonspecific weak hydrophobic or electrostatic forces, or by specific interactions with cell-surface components; fusion
15 with the plasma cell membrane by insertion of the lipid bilayer of the liposome into the plasma membrane, with simultaneous release of liposomal contents into the cytoplasm; and by transfer of liposomal lipids to cellular or subcellular membranes, or vice versa, without any association of the liposome contents. It often is difficult to determine which mechanism is operative and more than one may operate at the same time.

The fate and disposition of intravenously injected liposomes depend on
20 their physical properties, such as size, fluidity, and surface charge. They may persist in tissues for h or days, depending on their composition, and half lives in the blood range from min to several h. Larger liposomes, such as MLVs and LUVs, are taken up rapidly by phagocytic cells of the reticuloendothelial system, but physiology of the circulatory system restrains the exit of such large species at most sites. They can exit
25 only in places where large openings or pores exist in the capillary endothelium, such as the sinusoids of the liver or spleen. Thus, these organs are the predominate site of uptake. On the other hand, SUVs show a broader tissue distribution but still are sequestered highly in the liver and spleen. In general, this *in vivo* behavior limits the potential targeting of liposomes to only those organs and tissues accessible to their large
30 size. These include the blood, liver, spleen, bone marrow, and lymphoid organs.

Targeting is generally not a limitation in terms of the present invention. However, should specific targeting be desired, methods are available for this to be accomplished. Antibodies may be used to bind to the liposome surface and to direct the antibody and its drug contents to specific antigenic receptors located on a particular cell-type surface. Carbohydrate determinants (glycoprotein or glycolipid cell-surface components that play a role in cell-cell recognition, interaction and adhesion) may also be used as recognition sites as they have potential in directing liposomes to particular cell types. Mostly, it is contemplated that intravenous injection of liposomal preparations would be used, but other routes of administration are also conceivable.

Alternatively, the invention provides for pharmaceutically-acceptable nanocapsule formulations of the compositions of the present invention. Nanocapsules can generally entrap compounds in a stable and reproducible way (Henry-Michelland *et al.*, 1987; Quintanar-Guerrero *et al.*, 1998; Douglas *et al.*, 1987). To avoid side effects due to intracellular polymeric overloading, such ultrafine particles (sized around 0.1 μm) should be designed using polymers able to be degraded *in vivo*. Biodegradable polyalkyl-cyanoacrylate nanoparticles that meet these requirements are contemplated for use in the present invention. Such particles may be easily made, as described (Couvreur *et al.*, 1980; 1988; zur Muhlen *et al.*, 1998; Zambaux *et al.* 1998; Pinto-Alphandry *et al.*, 1995 and U. S. Patent 5,145,684, specifically incorporated herein by reference in its entirety).

VACCINES

In certain preferred embodiments of the present invention, vaccines are provided. The vaccines will generally comprise one or more pharmaceutical compositions, such as those discussed above, in combination with an immunostimulant. An immunostimulant may be any substance that enhances or potentiates an immune response (antibody and/or cell-mediated) to an exogenous antigen. Examples of immunostimulants include adjuvants, biodegradable microspheres (*e.g.*, polylactic galactide) and liposomes (into which the compound is incorporated; *see e.g.*, Fullerton, U.S. Patent No. 4,235,877). Vaccine preparation is generally described in, for example, M.F. Powell and M.J. Newman, eds., "Vaccine Design (the subunit and adjuvant

approach)," Plenum Press (NY, 1995). Pharmaceutical compositions and vaccines within the scope of the present invention may also contain other compounds, which may be biologically active or inactive. For example, one or more immunogenic portions of other tumor antigens may be present, either incorporated into a fusion
5 polypeptide or as a separate compound, within the composition or vaccine.

Illustrative vaccines may contain DNA encoding one or more of the polypeptides as described above, such that the polypeptide is generated *in situ*. As noted above, the DNA may be present within any of a variety of delivery systems known to those of ordinary skill in the art, including nucleic acid expression systems,
10 bacteria and viral expression systems. Numerous gene delivery techniques are well known in the art, such as those described by Rolland, *Crit. Rev. Therap. Drug Carrier Systems* 15:143-198, 1998, and references cited therein. Appropriate nucleic acid expression systems contain the necessary DNA sequences for expression in the patient (such as a suitable promoter and terminating signal). Bacterial delivery systems involve
15 the administration of a bacterium (such as *Bacillus-Calmette-Guerrin*) that expresses an immunogenic portion of the polypeptide on its cell surface or secretes such an epitope. In a preferred embodiment, the DNA may be introduced using a viral expression system (e.g., vaccinia or other pox virus, retrovirus, or adenovirus), which may involve the use of a non-pathogenic (defective), replication competent virus. Suitable systems are
20 disclosed, for example, in Fisher-Hoch et al., *Proc. Natl. Acad. Sci. USA* 86:317-321, 1989; Flexner et al., *Ann. N.Y. Acad. Sci.* 569:86-103, 1989; Flexner et al., *Vaccine* 8:17-21, 1990; U.S. Patent Nos. 4,603,112, 4,769,330, and 5,017,487; WO 89/01973; U.S. Patent No. 4,777,127; GB 2,200,651; EP 0,345,242; WO 91/02805; Berkner, *Biotechniques* 6:616-627, 1988; Rosenfeld et al., *Science* 252:431-434, 1991; Kolls et al., *Proc. Natl. Acad. Sci. USA* 91:215-219, 1994; Kass-Eisler et al., *Proc. Natl. Acad. Sci. USA* 90:11498-11502, 1993; Guzman et al., *Circulation* 88:2838-2848, 1993; and Guzman et al., *Cir. Res.* 73:1202-1207, 1993. Techniques for incorporating DNA into such expression systems are well known to those of ordinary skill in the art. The DNA may also be "naked," as described, for example, in Ulmer et al., *Science* 259:1745-1749,
25 1993 and reviewed by Cohen, *Science* 259:1691-1692, 1993. The uptake of naked DNA may be increased by coating the DNA onto biodegradable beads, which are

efficiently transported into the cells. It will be apparent that a vaccine may comprise both a polynucleotide and a polypeptide component. Such vaccines may provide for an enhanced immune response.

It will be apparent that a vaccine may contain pharmaceutically acceptable salts of the polynucleotides and polypeptides provided herein. Such salts may be prepared from pharmaceutically acceptable non-toxic bases, including organic bases (*e.g.*, salts of primary, secondary and tertiary amines and basic amino acids) and inorganic bases (*e.g.*, sodium, potassium, lithium, ammonium, calcium and magnesium salts).

While any suitable carrier known to those of ordinary skill in the art may be employed in the vaccine compositions of this invention, the type of carrier will vary depending on the mode of administration. Compositions of the present invention may be formulated for any appropriate manner of administration, including for example, topical, oral, nasal, intravenous, intracranial, intraperitoneal, subcutaneous or intramuscular administration. For parenteral administration, such as subcutaneous injection, the carrier preferably comprises water, saline, alcohol, a fat, a wax or a buffer. For oral administration, any of the above carriers or a solid carrier, such as mannitol, lactose, starch, magnesium stearate, sodium saccharine, talcum, cellulose, glucose, sucrose, and magnesium carbonate, may be employed. Biodegradable microspheres (*e.g.*, polylactate polyglycolate) may also be employed as carriers for the pharmaceutical compositions of this invention. Suitable biodegradable microspheres are disclosed, for example, in U.S. Patent Nos. 4,897,268; 5,075,109; 5,928,647; 5,811,128; 5,820,883; 5,853,763; 5,814,344 and 5,942,252. One may also employ a carrier comprising the particulate-protein complexes described in U.S. Patent No. 5,928,647, which are capable of inducing a class I-restricted cytotoxic T lymphocyte responses in a host.

Such compositions may also comprise buffers (*e.g.*, neutral buffered saline or phosphate buffered saline), carbohydrates (*e.g.*, glucose, mannose, sucrose or dextrans), mannitol, proteins, polypeptides or amino acids such as glycine, antioxidants, bacteriostats, chelating agents such as EDTA or glutathione, adjuvants (*e.g.*, aluminum hydroxide), solutes that render the formulation isotonic, hypotonic or weakly hypertonic

with the blood of a recipient, suspending agents, thickening agents and/or preservatives. Alternatively, compositions of the present invention may be formulated as a lyophilizate. Compounds may also be encapsulated within liposomes using well known technology.

5 Any of a variety of immunostimulants may be employed in the vaccines of this invention. For example, an adjuvant may be included. Most adjuvants contain a substance designed to protect the antigen from rapid catabolism, such as aluminum hydroxide or mineral oil, and a stimulator of immune responses, such as lipid A, *Bordetella pertussis* or *Mycobacterium tuberculosis* derived proteins. Suitable
10 adjuvants are commercially available as, for example, Freund's Incomplete Adjuvant and Complete Adjuvant (Difco Laboratories, Detroit, MI); Merck Adjuvant 65 (Merck and Company, Inc., Rahway, NJ); AS-2 (SmithKline Beecham, Philadelphia, PA); aluminum salts such as aluminum hydroxide gel (alum) or aluminum phosphate; salts of calcium, iron or zinc; an insoluble suspension of acylated tyrosine; acylated sugars;
15 cationically or anionically derivatized polysaccharides; polyphosphazenes; biodegradable microspheres; monophosphoryl lipid A and quil A. Cytokines, such as GM-CSF or interleukin-2, -7, or -12, may also be used as adjuvants.

 Within the vaccines provided herein, the adjuvant composition is preferably designed to induce an immune response predominantly of the Th1 type.
20 High levels of Th1-type cytokines (*e.g.*, IFN- γ , TNF α , IL-2 and IL-12) tend to favor the induction of cell mediated immune responses to an administered antigen. In contrast, high levels of Th2-type cytokines (*e.g.*, IL-4, IL-5, IL-6 and IL-10) tend to favor the induction of humoral immune responses. Following application of a vaccine as provided herein, a patient will support an immune response that includes Th1- and Th2-
25 type responses. Within a preferred embodiment, in which a response is predominantly Th1-type, the level of Th1-type cytokines will increase to a greater extent than the level of Th2-type cytokines. The levels of these cytokines may be readily assessed using standard assays. For a review of the families of cytokines, see Mosmann and Coffman, *Ann. Rev. Immunol.* 7:145-173, 1989.

30 Preferred adjuvants for use in eliciting a predominantly Th1-type response include, for example, a combination of monophosphoryl lipid A, preferably 3-

de-O-acylated monophosphoryl lipid A (3D-MPL), together with an aluminum salt. MPL adjuvants are available from Corixa Corporation (Seattle, WA; *see* US Patent Nos. 4,436,727; 4,877,611; 4,866,034 and 4,912,094). CpG-containing oligonucleotides (in which the CpG dinucleotide is unmethylated) also induce a predominantly Th1
5 response. Such oligonucleotides are well known and are described, for example, in WO 96/02555, WO 99/33488 and U.S. Patent Nos. 6,008,200 and 5,856,462. Immunostimulatory DNA sequences are also described, for example, by Sato et al., *Science* 273:352, 1996. Another preferred adjuvant is a saponin, preferably QS21 (Aquila Biopharmaceuticals Inc., Framingham, MA), which may be used alone or in
10 combination with other adjuvants. For example, an enhanced system involves the combination of a monophosphoryl lipid A and saponin derivative, such as the combination of QS21 and 3D-MPL as described in WO 94/00153, or a less reactogenic composition where the QS21 is quenched with cholesterol, as described in WO 96/33739. Other preferred formulations comprise an oil-in-water emulsion and
15 tocopherol. A particularly potent adjuvant formulation involving QS21, 3D-MPL and tocopherol in an oil-in-water emulsion is described in WO 95/17210.

Other preferred adjuvants include Montanide ISA 720 (Seppic, France), SAF (Chiron, California, United States), ISCOMS (CSL), MF-59 (Chiron), the SBAS series of adjuvants (*e.g.*, SBAS-2 or SBAS-4, available from SmithKline Beecham,
20 Rixensart, Belgium), Detox (Corixa, Hamilton, MT), RC-529 (Corixa, Hamilton, MT) and other aminoalkyl glucosaminide 4-phosphates (AGPs), such as those described in pending U.S. Patent Application Serial Nos. 08/853,826 and 09/074,720, the disclosures of which are incorporated herein by reference in their entireties.

Any vaccine provided herein may be prepared using well known
25 methods that result in a combination of antigen, immune response enhancer and a suitable carrier or excipient. The compositions described herein may be administered as part of a sustained release formulation (*i.e.*, a formulation such as a capsule, sponge or gel (composed of polysaccharides, for example) that effects a slow release of compound following administration). Such formulations may generally be prepared using well
30 known technology (*see, e.g.*, Coombes et al., *Vaccine* 14:1429-1438, 1996) and administered by, for example, oral, rectal or subcutaneous implantation, or by

implantation at the desired target site. Sustained-release formulations may contain a polypeptide, polynucleotide or antibody dispersed in a carrier matrix and/or contained within a reservoir surrounded by a rate controlling membrane.

Carriers for use within such formulations are biocompatible, and may also be biodegradable; preferably the formulation provides a relatively constant level of active component release. Such carriers include microparticles of poly(lactide-co-glycolide), polyacrylate, latex, starch, cellulose, dextran and the like. Other delayed-release carriers include supramolecular biovectors, which comprise a non-liquid hydrophilic core (*e.g.*, a cross-linked polysaccharide or oligosaccharide) and, optionally, an external layer comprising an amphiphilic compound, such as a phospholipid (*see e.g.*, U.S. Patent No. 5,151,254 and PCT applications WO 94/20078, WO/94/23701 and WO 96/06638). The amount of active compound contained within a sustained release formulation depends upon the site of implantation, the rate and expected duration of release and the nature of the condition to be treated or prevented.

Any of a variety of delivery vehicles may be employed within pharmaceutical compositions and vaccines to facilitate production of an antigen-specific immune response that targets tumor cells. Delivery vehicles include antigen presenting cells (APCs), such as dendritic cells, macrophages, B cells, monocytes and other cells that may be engineered to be efficient APCs. Such cells may, but need not, be genetically modified to increase the capacity for presenting the antigen, to improve activation and/or maintenance of the T cell response, to have anti-tumor effects *per se* and/or to be immunologically compatible with the receiver (*i.e.*, matched HLA haplotype). APCs may generally be isolated from any of a variety of biological fluids and organs, including tumor and peritumoral tissues, and may be autologous, allogeneic, syngeneic or xenogeneic cells.

Certain preferred embodiments of the present invention use dendritic cells or progenitors thereof as antigen-presenting cells. Dendritic cells are highly potent APCs (Banchereau and Steinman, *Nature* 392:245-251, 1998) and have been shown to be effective as a physiological adjuvant for eliciting prophylactic or therapeutic antitumor immunity (*see* Timmerman and Levy, *Ann. Rev. Med.* 50:507-529, 1999). In general, dendritic cells may be identified based on their typical shape (stellate *in situ*,

with marked cytoplasmic processes (dendrites) visible *in vitro*), their ability to take up, process and present antigens with high efficiency and their ability to activate naïve T cell responses. Dendritic cells may, of course, be engineered to express specific cell-surface receptors or ligands that are not commonly found on dendritic cells *in vivo* or *ex vivo*, and such modified dendritic cells are contemplated by the present invention. As an alternative to dendritic cells, secreted vesicles antigen-loaded dendritic cells (called exosomes) may be used within a vaccine (*see* Zitvogel et al., *Nature Med.* 4:594-600, 1998).

Dendritic cells and progenitors may be obtained from peripheral blood, bone marrow, tumor-infiltrating cells, peritumoral tissues-infiltrating cells, lymph nodes, spleen, skin, umbilical cord blood or any other suitable tissue or fluid. For example, dendritic cells may be differentiated *ex vivo* by adding a combination of cytokines such as GM-CSF, IL-4, IL-13 and/or TNF α to cultures of monocytes harvested from peripheral blood. Alternatively, CD34 positive cells harvested from peripheral blood, umbilical cord blood or bone marrow may be differentiated into dendritic cells by adding to the culture medium combinations of GM-CSF, IL-3, TNF α , CD40 ligand, LPS, flt3 ligand and/or other compound(s) that induce differentiation, maturation and proliferation of dendritic cells.

Dendritic cells are conveniently categorized as "immature" and "mature" cells, which allows a simple way to discriminate between two well characterized phenotypes. However, this nomenclature should not be construed to exclude all possible intermediate stages of differentiation. Immature dendritic cells are characterized as APC with a high capacity for antigen uptake and processing, which correlates with the high expression of Fc γ receptor and mannose receptor. The mature phenotype is typically characterized by a lower expression of these markers, but a high expression of cell surface molecules responsible for T cell activation such as class I and class II MHC, adhesion molecules (*e.g.*, CD54 and CD11) and costimulatory molecules (*e.g.*, CD40, CD80, CD86 and 4-1BB).

APCs may generally be transfected with a polynucleotide encoding a breast tumor protein (or portion or other variant thereof) such that the breast tumor polypeptide, or an immunogenic portion thereof, is expressed on the cell surface. Such

transfection may take place *ex vivo*, and a composition or vaccine comprising such transfected cells may then be used for therapeutic purposes, as described herein. Alternatively, a gene delivery vehicle that targets a dendritic or other antigen presenting cell may be administered to a patient, resulting in transfection that occurs *in vivo*. *In vivo* and *ex vivo* transfection of dendritic cells, for example, may generally be performed using any methods known in the art, such as those described in WO 97/24447, or the gene gun approach described by Mahvi et al., *Immunology and cell Biology* 75:456-460, 1997. Antigen loading of dendritic cells may be achieved by incubating dendritic cells or progenitor cells with the breast tumor polypeptide, DNA (naked or within a plasmid vector) or RNA; or with antigen-expressing recombinant bacterium or viruses (*e.g.*, vaccinia, fowlpox, adenovirus or lentivirus vectors). Prior to loading, the polypeptide may be covalently conjugated to an immunological partner that provides T cell help (*e.g.*, a carrier molecule). Alternatively, a dendritic cell may be pulsed with a non-conjugated immunological partner, separately or in the presence of the polypeptide.

Vaccines and pharmaceutical compositions may be presented in unit-dose or multi-dose containers, such as sealed ampoules or vials. Such containers are preferably hermetically sealed to preserve sterility of the formulation until use. In general, formulations may be stored as suspensions, solutions or emulsions in oily or aqueous vehicles. Alternatively, a vaccine or pharmaceutical composition may be stored in a freeze-dried condition requiring only the addition of a sterile liquid carrier immediately prior to use.

CANCER THERAPY

In further aspects of the present invention, the compositions described herein may be used for immunotherapy of cancer, such as breast cancer. Within such methods, pharmaceutical compositions and vaccines are typically administered to a patient. As used herein, a "patient" refers to any warm-blooded animal, preferably a human. A patient may or may not be afflicted with cancer. Accordingly, the above pharmaceutical compositions and vaccines may be used to prevent the development of a cancer or to treat a patient afflicted with a cancer. A cancer may be diagnosed using

criteria generally accepted in the art, including the presence of a malignant tumor. Pharmaceutical compositions and vaccines may be administered either prior to or following surgical removal of primary tumors and/or treatment such as administration of radiotherapy or conventional chemotherapeutic drugs. Administration may be by any
5 suitable method, including administration by intravenous, intraperitoneal, intramuscular, subcutaneous, intranasal, intradermal, anal, vaginal, topical and oral routes.

Within certain embodiments, immunotherapy may be active immunotherapy, in which treatment relies on the *in vivo* stimulation of the endogenous
10 host immune system to react against tumors with the administration of immune response-modifying agents (such as polypeptides and polynucleotides as provided herein).

Within other embodiments, immunotherapy may be passive immunotherapy, in which treatment involves the delivery of agents with established
15 tumor-immune reactivity (such as effector cells or antibodies) that can directly or indirectly mediate antitumor effects and does not necessarily depend on an intact host immune system. Examples of effector cells include T cells as discussed above, T lymphocytes (such as CD8⁺ cytotoxic T lymphocytes and CD4⁺ T-helper tumor-infiltrating lymphocytes), killer cells (such as Natural Killer cells and lymphokine-activated killer cells), B cells and antigen-presenting cells (such as dendritic cells and
20 macrophages) expressing a polypeptide provided herein. T cell receptors and antibody receptors specific for the polypeptides recited herein may be cloned, expressed and transferred into other vectors or effector cells for adoptive immunotherapy. The polypeptides provided herein may also be used to generate antibodies or anti-idiotypic
25 antibodies (as described above and in U.S. Patent No. 4,918,164) for passive immunotherapy.

Effector cells may generally be obtained in sufficient quantities for adoptive immunotherapy by growth *in vitro*, as described herein. Culture conditions for expanding single antigen-specific effector cells to several billion in number with
30 retention of antigen recognition *in vivo* are well known in the art. Such *in vitro* culture conditions typically use intermittent stimulation with antigen, often in the presence of

cytokines (such as IL-2) and non-dividing feeder cells. As noted above, immunoreactive polypeptides as provided herein may be used to rapidly expand antigen-specific T cell cultures in order to generate a sufficient number of cells for immunotherapy. In particular, antigen-presenting cells, such as dendritic, macrophage, 5 monocyte, fibroblast and/or B cells, may be pulsed with immunoreactive polypeptides or transfected with one or more polynucleotides using standard techniques well known in the art. For example, antigen-presenting cells can be transfected with a polynucleotide having a promoter appropriate for increasing expression in a recombinant virus or other expression system. Cultured effector cells for use in therapy 10 must be able to grow and distribute widely, and to survive long term *in vivo*. Studies have shown that cultured effector cells can be induced to grow *in vivo* and to survive long term in substantial numbers by repeated stimulation with antigen supplemented with IL-2 (*see*, for example, Cheever et al., *Immunological Reviews* 157:177, 1997).

Alternatively, a vector expressing a polypeptide recited herein may be 15 introduced into antigen presenting cells taken from a patient and clonally propagated *ex vivo* for transplant back into the same patient. Transfected cells may be reintroduced into the patient using any means known in the art, preferably in sterile form by intravenous, intracavitary, intraperitoneal or intratumor administration.

Routes and frequency of administration of the therapeutic compositions 20 described herein, as well as dosage, will vary from individual to individual, and may be readily established using standard techniques. In general, the pharmaceutical compositions and vaccines may be administered by injection (*e.g.*, intracutaneous, intramuscular, intravenous or subcutaneous), intranasally (*e.g.*, by aspiration) or orally. Preferably, between 1 and 10 doses may be administered over a 52 week period. 25 Preferably, 6 doses are administered, at intervals of 1 month, and booster vaccinations may be given periodically thereafter. Alternate protocols may be appropriate for individual patients. A suitable dose is an amount of a compound that, when administered as described above, is capable of promoting an anti-tumor immune response, and is at least 10-50% above the basal (*i.e.*, untreated) level. Such response 30 can be monitored by measuring the anti-tumor antibodies in a patient or by vaccine-dependent generation of cytolytic effector cells capable of killing the patient's tumor

cells *in vitro*. Such vaccines should also be capable of causing an immune response that leads to an improved clinical outcome (*e.g.*, more frequent remissions, complete or partial or longer disease-free survival) in vaccinated patients as compared to non-vaccinated patients. In general, for pharmaceutical compositions and vaccines
5 comprising one or more polypeptides, the amount of each polypeptide present in a dose ranges from about 25 µg to 5 mg per kg of host. Suitable dose sizes will vary with the size of the patient, but will typically range from about 0.1 mL to about 5 mL.

In general, an appropriate dosage and treatment regimen provides the active compound(s) in an amount sufficient to provide therapeutic and/or prophylactic
10 benefit. Such a response can be monitored by establishing an improved clinical outcome (*e.g.*, more frequent remissions, complete or partial, or longer disease-free survival) in treated patients as compared to non-treated patients. Increases in preexisting immune responses to a breast tumor protein generally correlate with an improved clinical outcome. Such immune responses may generally be evaluated using
15 standard proliferation, cytotoxicity or cytokine assays, which may be performed using samples obtained from a patient before and after treatment.

CANCER DETECTION AND DIAGNOSIS

In general, a cancer may be detected in a patient based on the presence of one or more breast tumor proteins and/or polynucleotides encoding such proteins in a
20 biological sample (for example, blood, sera, sputum urine and/or tumor biopsies) obtained from the patient. In other words, such proteins may be used as markers to indicate the presence or absence of a cancer such as breast cancer. In addition, such proteins may be useful for the detection of other cancers. The binding agents provided herein generally permit detection of the level of antigen that binds to the agent in the
25 biological sample. Polynucleotide primers and probes may be used to detect the level of mRNA encoding a tumor protein, which is also indicative of the presence or absence of a cancer. In general, a breast tumor sequence should be present at a level that is at least three fold higher in tumor tissue than in normal tissue

There are a variety of assay formats known to those of ordinary skill in
30 the art for using a binding agent to detect polypeptide markers in a sample. *See, e.g.*,

Harlow and Lane, *Antibodies: A Laboratory Manual*, Cold Spring Harbor Laboratory, 1988. In general, the presence or absence of a cancer in a patient may be determined by (a) contacting a biological sample obtained from a patient with a binding agent; (b) detecting in the sample a level of polypeptide that binds to the binding agent; and (c)
5 comparing the level of polypeptide with a predetermined cut-off value.

In a preferred embodiment, the assay involves the use of binding agent immobilized on a solid support to bind to and remove the polypeptide from the remainder of the sample. The bound polypeptide may then be detected using a detection reagent that contains a reporter group and specifically binds to the binding
10 agent/polypeptide complex. Such detection reagents may comprise, for example, a binding agent that specifically binds to the polypeptide or an antibody or other agent that specifically binds to the binding agent, such as an anti-immunoglobulin, protein G, protein A or a lectin. Alternatively, a competitive assay may be utilized, in which a polypeptide is labeled with a reporter group and allowed to bind to the immobilized
15 binding agent after incubation of the binding agent with the sample. The extent to which components of the sample inhibit the binding of the labeled polypeptide to the binding agent is indicative of the reactivity of the sample with the immobilized binding agent. Suitable polypeptides for use within such assays include full length breast tumor proteins and portions thereof to which the binding agent binds, as described above.

20 The solid support may be any material known to those of ordinary skill in the art to which the tumor protein may be attached. For example, the solid support may be a test well in a microtiter plate or a nitrocellulose or other suitable membrane. Alternatively, the support may be a bead or disc, such as glass, fiberglass, latex or a plastic material such as polystyrene or polyvinylchloride. The support may also be a
25 magnetic particle or a fiber optic sensor, such as those disclosed, for example, in U.S. Patent No. 5,359,681. The binding agent may be immobilized on the solid support using a variety of techniques known to those of skill in the art, which are amply described in the patent and scientific literature. In the context of the present invention, the term "immobilization" refers to both noncovalent association, such as adsorption,
30 and covalent attachment (which may be a direct linkage between the agent and functional groups on the support or may be a linkage by way of a cross-linking agent).

Immobilization by adsorption to a well in a microtiter plate or to a membrane is preferred. In such cases, adsorption may be achieved by contacting the binding agent, in a suitable buffer, with the solid support for a suitable amount of time. The contact time varies with temperature, but is typically between about 1 hour and about 1 day. In
5 general, contacting a well of a plastic microtiter plate (such as polystyrene or polyvinylchloride) with an amount of binding agent ranging from about 10 ng to about 10 μ g, and preferably about 100 ng to about 1 μ g, is sufficient to immobilize an adequate amount of binding agent.

Covalent attachment of binding agent to a solid support may generally be
10 achieved by first reacting the support with a bifunctional reagent that will react with both the support and a functional group, such as a hydroxyl or amino group, on the binding agent. For example, the binding agent may be covalently attached to supports having an appropriate polymer coating using benzoquinone or by condensation of an aldehyde group on the support with an amine and an active hydrogen on the binding
15 partner (*see, e.g.*, Pierce Immunotechnology Catalog and Handbook, 1991, at A12-A13).

In certain embodiments, the assay is a two-antibody sandwich assay. This assay may be performed by first contacting an antibody that has been immobilized on a solid support, commonly the well of a microtiter plate, with the sample, such that
20 polypeptides within the sample are allowed to bind to the immobilized antibody. Unbound sample is then removed from the immobilized polypeptide-antibody complexes and a detection reagent (preferably a second antibody capable of binding to a different site on the polypeptide) containing a reporter group is added. The amount of detection reagent that remains bound to the solid support is then determined using a
25 method appropriate for the specific reporter group.

More specifically, once the antibody is immobilized on the support as described above, the remaining protein binding sites on the support are typically blocked. Any suitable blocking agent known to those of ordinary skill in the art, such as bovine serum albumin or Tween 20™ (Sigma Chemical Co., St. Louis, MO). The
30 immobilized antibody is then incubated with the sample, and polypeptide is allowed to bind to the antibody. The sample may be diluted with a suitable diluent, such as

phosphate-buffered saline (PBS) prior to incubation. In general, an appropriate contact time (*i.e.*, incubation time) is a period of time that is sufficient to detect the presence of polypeptide within a sample obtained from an individual with breast cancer. Preferably, the contact time is sufficient to achieve a level of binding that is at least about 95% of that achieved at equilibrium between bound and unbound polypeptide. Those of ordinary skill in the art will recognize that the time necessary to achieve equilibrium may be readily determined by assaying the level of binding that occurs over a period of time. At room temperature, an incubation time of about 30 minutes is generally sufficient.

10 Unbound sample may then be removed by washing the solid support with an appropriate buffer, such as PBS containing 0.1% Tween 20™. The second antibody, which contains a reporter group, may then be added to the solid support. Preferred reporter groups include those groups recited above.

The detection reagent is then incubated with the immobilized antibody-polypeptide complex for an amount of time sufficient to detect the bound polypeptide. An appropriate amount of time may generally be determined by assaying the level of binding that occurs over a period of time. Unbound detection reagent is then removed and bound detection reagent is detected using the reporter group. The method employed for detecting the reporter group depends upon the nature of the reporter group. For radioactive groups, scintillation counting or autoradiographic methods are generally appropriate. Spectroscopic methods may be used to detect dyes, luminescent groups and fluorescent groups. Biotin may be detected using avidin, coupled to a different reporter group (commonly a radioactive or fluorescent group or an enzyme). Enzyme reporter groups may generally be detected by the addition of substrate (generally for a specific period of time), followed by spectroscopic or other analysis of the reaction products.

To determine the presence or absence of a cancer, such as breast cancer, the signal detected from the reporter group that remains bound to the solid support is generally compared to a signal that corresponds to a predetermined cut-off value. In one preferred embodiment, the cut-off value for the detection of a cancer is the average mean signal obtained when the immobilized antibody is incubated with samples from

patients without the cancer. In general, a sample generating a signal that is three standard deviations above the predetermined cut-off value is considered positive for the cancer. In an alternate preferred embodiment, the cut-off value is determined using a Receiver Operator Curve, according to the method of Sackett et al., *Clinical*
5 *Epidemiology: A Basic Science for Clinical Medicine*, Little Brown and Co., 1985, p. 106-7. Briefly, in this embodiment, the cut-off value may be determined from a plot of pairs of true positive rates (*i.e.*, sensitivity) and false positive rates (100%-specificity) that correspond to each possible cut-off value for the diagnostic test result. The cut-off value on the plot that is the closest to the upper left-hand corner (*i.e.*, the value that
10 encloses the largest area) is the most accurate cut-off value, and a sample generating a signal that is higher than the cut-off value determined by this method may be considered positive. Alternatively, the cut-off value may be shifted to the left along the plot, to minimize the false positive rate, or to the right, to minimize the false negative rate. In general, a sample generating a signal that is higher than the cut-off value determined by
15 this method is considered positive for a cancer.

In a related embodiment, the assay is performed in a flow-through or strip test format, wherein the binding agent is immobilized on a membrane, such as nitrocellulose. In the flow-through test, polypeptides within the sample bind to the immobilized binding agent as the sample passes through the membrane. A second,
20 labeled binding agent then binds to the binding agent-polypeptide complex as a solution containing the second binding agent flows through the membrane. The detection of bound second binding agent may then be performed as described above. In the strip test format, one end of the membrane to which binding agent is bound is immersed in a solution containing the sample. The sample migrates along the membrane through a
25 region containing second binding agent and to the area of immobilized binding agent. Concentration of second binding agent at the area of immobilized antibody indicates the presence of a cancer. Typically, the concentration of second binding agent at that site generates a pattern, such as a line, that can be read visually. The absence of such a pattern indicates a negative result. In general, the amount of binding agent immobilized
30 on the membrane is selected to generate a visually discernible pattern when the biological sample contains a level of polypeptide that would be sufficient to generate a

positive signal in the two-antibody sandwich assay, in the format discussed above. Preferred binding agents for use in such assays are antibodies and antigen-binding fragments thereof. Preferably, the amount of antibody immobilized on the membrane ranges from about 25 ng to about 1 µg, and more preferably from about 50 ng to about 500 ng. Such tests can typically be performed with a very small amount of biological sample.

Of course, numerous other assay protocols exist that are suitable for use with the tumor proteins or binding agents of the present invention. The above descriptions are intended to be exemplary only. For example, it will be apparent to those of ordinary skill in the art that the above protocols may be readily modified to use breast tumor polypeptides to detect antibodies that bind to such polypeptides in a biological sample. The detection of such breast tumor protein specific antibodies may correlate with the presence of a cancer.

A cancer may also, or alternatively, be detected based on the presence of T cells that specifically react with a breast tumor protein in a biological sample. Within certain methods, a biological sample comprising CD4⁺ and/or CD8⁺ T cells isolated from a patient is incubated with a breast tumor polypeptide, a polynucleotide encoding such a polypeptide and/or an APC that expresses at least an immunogenic portion of such a polypeptide, and the presence or absence of specific activation of the T cells is detected. Suitable biological samples include, but are not limited to, isolated T cells. For example, T cells may be isolated from a patient by routine techniques (such as by Ficoll/Hypaque density gradient centrifugation of peripheral blood lymphocytes). T cells may be incubated *in vitro* for 2-9 days (typically 4 days) at 37°C with polypeptide (e.g., 5 - 25 µg/ml). It may be desirable to incubate another aliquot of a T cell sample in the absence of breast tumor polypeptide to serve as a control. For CD4⁺ T cells, activation is preferably detected by evaluating proliferation of the T cells. For CD8⁺ T cells, activation is preferably detected by evaluating cytolytic activity. A level of proliferation that is at least two fold greater and/or a level of cytolytic activity that is at least 20% greater than in disease-free patients indicates the presence of a cancer in the patient.

As noted above, a cancer may also, or alternatively, be detected based on the level of mRNA encoding a breast tumor protein in a biological sample. For example, at least two oligonucleotide primers may be employed in a polymerase chain reaction (PCR) based assay to amplify a portion of a breast tumor cDNA derived from a biological sample, wherein at least one of the oligonucleotide primers is specific for (i.e., hybridizes to) a polynucleotide encoding the breast tumor protein. The amplified cDNA is then separated and detected using techniques well known in the art, such as gel electrophoresis. Similarly, oligonucleotide probes that specifically hybridize to a polynucleotide encoding a breast tumor protein may be used in a hybridization assay to detect the presence of polynucleotide encoding the tumor protein in a biological sample.

To permit hybridization under assay conditions, oligonucleotide primers and probes should comprise an oligonucleotide sequence that has at least about 60%, preferably at least about 75% and more preferably at least about 90%, identity to a portion of a polynucleotide encoding a breast tumor protein that is at least 10 nucleotides, and preferably at least 20 nucleotides, in length. Preferably, oligonucleotide primers and/or probes hybridize to a polynucleotide encoding a polypeptide described herein under moderately stringent conditions, as defined above. Oligonucleotide primers and/or probes which may be usefully employed in the diagnostic methods described herein preferably are at least 10-40 nucleotides in length. In a preferred embodiment, the oligonucleotide primers comprise at least 10 contiguous nucleotides, more preferably at least 15 contiguous nucleotides, of a DNA molecule having a sequence recited in SEQ ID NO: 1-38, 42-204, 205, 207 and 210-290. Techniques for both PCR based assays and hybridization assays are well known in the art (see, for example, Mullis et al., *Cold Spring Harbor Symp. Quant. Biol.*, 51:263, 1987; Erlich ed., *PCR Technology*, Stockton Press, NY, 1989).

One preferred assay employs RT-PCR, in which PCR is applied in conjunction with reverse transcription. Typically, RNA is extracted from a biological sample, such as biopsy tissue, and is reverse transcribed to produce cDNA molecules. PCR amplification using at least one specific primer generates a cDNA molecule, which may be separated and visualized using, for example, gel electrophoresis. Amplification may be performed on biological samples taken from a test patient and from an

individual who is not afflicted with a cancer. The amplification reaction may be performed on several dilutions of cDNA spanning two orders of magnitude. A two-fold or greater increase in expression in several dilutions of the test patient sample as compared to the same dilutions of the non-cancerous sample is typically considered
5 positive.

In another embodiment, the compositions described herein may be used as markers for the progression of cancer. In this embodiment, assays as described above for the diagnosis of a cancer may be performed over time, and the change in the level of reactive polypeptide(s) or polynucleotide(s) evaluated. For example, the assays
10 may be performed every 24-72 hours for a period of 6 months to 1 year, and thereafter performed as needed. In general, a cancer is progressing in those patients in whom the level of polypeptide or polynucleotide detected increases over time. In contrast, the cancer is not progressing when the level of reactive polypeptide or polynucleotide either remains constant or decreases with time.

15 Certain *in vivo* diagnostic assays may be performed directly on a tumor. One such assay involves contacting tumor cells with a binding agent. The bound binding agent may then be detected directly or indirectly via a reporter group. Such binding agents may also be used in histological applications. Alternatively, polynucleotide probes may be used within such applications.

20 As noted above, to improve sensitivity, multiple breast tumor protein markers may be assayed within a given sample. It will be apparent that binding agents specific for different proteins provided herein may be combined within a single assay. Further, multiple primers or probes may be used concurrently. The selection of tumor protein markers may be based on routine experiments to determine combinations that
25 results in optimal sensitivity. In addition, or alternatively, assays for tumor proteins provided herein may be combined with assays for other known tumor antigens.

DIAGNOSTIC KITS

The present invention further provides kits for use within any of the above diagnostic methods. Such kits typically comprise two or more components
30 necessary for performing a diagnostic assay. Components may be compounds,

reagents, containers and/or equipment. For example, one container within a kit may contain a monoclonal antibody or fragment thereof that specifically binds to a breast tumor protein. Such antibodies or fragments may be provided attached to a support material, as described above. One or more additional containers may enclose elements,
5 such as reagents or buffers, to be used in the assay. Such kits may also, or alternatively, contain a detection reagent as described above that contains a reporter group suitable for direct or indirect detection of antibody binding.

Alternatively, a kit may be designed to detect the level of mRNA encoding a breast tumor protein in a biological sample. Such kits generally comprise at
10 least one oligonucleotide probe or primer, as described above, that hybridizes to a polynucleotide encoding a breast tumor protein. Such an oligonucleotide may be used, for example, within a PCR or hybridization assay. Additional components that may be present within such kits include a second oligonucleotide and/or a diagnostic reagent or container to facilitate the detection of a polynucleotide encoding a breast tumor protein.

15 The following Examples are offered by way of illustration and not by way of limitation.

EXAMPLE 1

IDENTIFICATION OF BREAST TUMOR PROTEIN cDNAS USING
SUBTRACTION METHODOLOGY

This Example illustrates the identification of cDNA molecules encoding
5 breast tumor proteins.

A human metastatic breast tumor cDNA expression library was constructed from metastatic breast tumor poly A⁺ RNA using a Superscript Plasmid System for cDNA Synthesis and Plasmid Cloning kit (BRL Life Technologies, Gaithersburg, MD 20897) following the manufacturer's protocol. Specifically, breast
10 tumor tissues were homogenized with polytron (Kinematica, Switzerland) and total RNA was extracted using Trizol reagent (BRL Life Technologies) as directed by the manufacturer. The poly A⁺ RNA was then purified using a Qiagen oligotex spin column mRNA purification kit (Qiagen, Santa Clarita, CA 91355) according to the manufacturer's protocol. First-strand cDNA was synthesized using the NotI/Oligo-
15 dT18 primer. Double-stranded cDNA was synthesized, ligated with EcoRI/BstX I adaptors (Invitrogen, Carlsbad, CA) and digested with NotI. Following size fractionation with Chroma Spin-1000 columns (Clontech, Palo Alto, CA 94303), the cDNA was ligated into the EcoRI/NotI site of pCDNA3.1 (Invitrogen, Carlsbad, CA) and transformed into ElectroMax *E. coli* DH10B cells (BRL Life Technologies) by
20 electroporation.

Using the same procedure, a normal human breast cDNA expression library was prepared from a pool of four normal breast tissue specimens. The cDNA libraries were characterized by determining the number of independent colonies, the percentage of clones that carried insert, the average insert size and by sequence analysis.
25 Sequencing analysis showed both libraries to contain good complex cDNA clones that were synthesized from mRNA, with minimal rRNA and mitochondrial DNA contamination sequencing.

A cDNA subtracted library (referred to as BS3) was prepared using the above metastatic breast tumor and normal breast cDNA libraries, as described by Hara
30 *et al.* (*Blood*, 84:189-199, 1994) with some modifications. Specifically, a breast tumor-

specific subtracted cDNA library was generated as follows. Normal breast cDNA library (70 µg) was digested with EcoRI, NotI, and SfuI, followed by a filling-in reaction with DNA polymerase Klenow fragment. After phenol-chloroform extraction and ethanol precipitation, the DNA was dissolved in 100 µl of H₂O, heat-denatured and
5 mixed with 100 µl (100 µg) of Photoprobe biotin (Vector Laboratories, Burlingame, CA), the resulting mixture was irradiated with a 270 W sunlamp on ice for 20 minutes. Additional Photoprobe biotin (50 µl) was added and the biotinylation reaction was repeated. After extraction with butanol five times, the DNA was ethanol-precipitated and dissolved in 23 µl H₂O to form the driver DNA.

10 To form the tracer DNA, 10 µg breast tumor cDNA library was digested with BamHI and XhoI, phenol chloroform extracted and passed through Chroma spin-400 columns (Clontech). Following ethanol precipitation, the tracer DNA was dissolved in 5 µl H₂O. Tracer DNA was mixed with 15 µl driver DNA and 20 µl of 2 x hybridization buffer (1.5 M NaCl/10 mM EDTA/50 mM HEPES pH 7.5/0.2% sodium
15 dodecyl sulfate), overlaid with mineral oil, and heat-denatured completely. The sample was immediately transferred into a 68 °C water bath and incubated for 20 hours (long hybridization [LH]). The reaction mixture was then subjected to a streptavidin treatment followed by phenol/chloroform extraction. This process was repeated three more times. Subtracted DNA was precipitated, dissolved in 12 µl H₂O, mixed with 8 µl
20 driver DNA and 20 µl of 2 x hybridization buffer, and subjected to a hybridization at 68 °C for 2 hours (short hybridization [SH]). After removal of biotinylated double-stranded DNA, subtracted cDNA was ligated into BamHI/XhoI site of chloramphenicol resistant pBCSK⁺ (Stratagene, La Jolla, CA 92037) and transformed into ElectroMax *E. coli* DH10B cells by electroporation to generate a breast tumor specific subtracted
25 cDNA library.

To analyze the subtracted cDNA library, plasmid DNA was prepared from independent clones, randomly picked from the subtracted breast tumor specific library and characterized by DNA sequencing with a Perkin Elmer/Applied Biosystems Division Automated Sequencer Model 373A (Foster City, CA).

30 A second cDNA subtraction library containing cDNA from breast tumor subtracted with normal breast cDNA, and known as BT, was constructed as follows.

Total RNA was extracted from primary breast tumor tissues using Trizol reagent (Gibco BRL Life Technologies, Gaithersburg, MD) as described by the manufacturer. The polyA⁺ RNA was purified using an oligo(dT) cellulose column according to standard protocols. First strand cDNA was synthesized using the primer supplied in a Clontech
5 PCR-Select cDNA Subtraction Kit (Clontech, Palo Alto, CA). The driver DNA consisted of cDNAs from two normal breast tissues with the tester cDNA being from three primary breast tumors. Double-stranded cDNA was synthesized for both tester and driver, and digested with a combination of endonucleases (MluI, MscI, PvuII, Sall and StuI) which recognize six base pairs DNA. This modification increased the average
10 cDNA size dramatically compared with cDNAs generated according to the protocol of Clontech. The digested tester cDNAs were ligated to two different adaptors and the subtraction was performed according to Clontech's protocol. The subtracted cDNAs were subjected to two rounds of PCR amplification, following the manufacturer's protocol. The resulting PCR products were subcloned into the TA cloning vector,
15 pCRII (Invitrogen, San Diego, CA) and transformed into ElectroMax *E. coli* DH10B cells (Gibco BRL Life, Technologies) by electroporation. DNA was isolated from independent clones and sequenced using a Perkin Elmer/Applied Biosystems Division (Foster City, CA) Automated Sequencer Model 373A.

Two additional subtracted cDNA libraries were prepared from cDNA
20 from breast tumors subtracted with a pool of cDNA from six normal tissues (liver, brain, stomach, small intestine, kidney and heart; referred to as 2BT and BC6) using the PCR-subtraction protocol of Clontech, described above. A fourth subtracted library (referred to as Bt-Met) was prepared using the protocol of Clontech from cDNA from metastatic breast tumors subtracted with cDNA from five normal tissues (brain, lung,
25 PBMC, pancreas and normal breast).

cDNA clones isolated in the breast subtractions BS3, BT, 2BT, BC6 and BT-Met, described above, were colony PCR amplified and their mRNA expression levels in breast tumor, normal breast and various other normal tissues were determined using microarray technology. Briefly, the PCR amplification products were dotted onto
30 slides in an array format, with each product occupying a unique location in the array. mRNA was extracted from the tissue sample to be tested, reverse transcribed, and

fluorescent-labeled cDNA probes were generated. The microarrays were probed with the labeled cDNA probes, the slides scanned and fluorescence intensity was measured. This intensity correlates with the hybridization intensity.

The determined cDNA sequences of 131 clones determined to be over-expressed in breast tumor tissue compared to other tissues tested by a visual analysis of the microarray data are provided in SEQ ID NO: 1-35 and 42-137. Comparison of these cDNA sequences with known sequences in the gene bank using the EMBL and GenBank databases revealed no significant homologies to the sequences provided in SEQ ID NO: 7, 10, 21, 26, 30, 63, 81 and 104. The sequences of SEQ ID NO: 2-5, 8, 9, 13, 15, 16, 22, 25, 27, 28, 33, 35, 72, 73, 103, 107, 109, 118, 128, 129 134 and 136 showed some homology to previously isolated expressed sequences tags (ESTs), while the sequences of SEQ ID NO: 1, 6, 11, 12, 14, 17-20, 23, 24, 29, 31, 32, 34, 42-62, 64-71, 74-80, 82-102, 105, 106, 108, 110-117, 119-127, 130-133, 135 and 137 showed some homology to previously identified genes.

The determined cDNA sequences of an additional 45 clones isolated from the BT-Met library as described above and found to be over-expressed in breast tumors and metastatic breast tumors compared to other tissues tested, are provided in SEQ ID NO: 138-182. Comparison of the sequences of SEQ ID NO: 159-161, 164 and 181 revealed no significant homologies to previously identified sequences. The sequences of SEQ ID NO: 138-158, 162, 163, 165-180 and 182 showed some homology to previously identified genes.

In further studies, suppression subtractive hybridization (Clontech) was preformed using a pool of cDNA from 3 unique human breast tumors as the tester and a pool of cDNA from 6 other normal human tissues (liver, brain, stomach, small intestine, heart and kidney) as the driver. The isolated cDNA fragments were subcloned and characterized by DNA sequencing. The determined cDNA sequences of 22 isolated clones are provided in SEQ ID NO: 183-204. Comparison of these sequences with those in the public databases revealed no significant homologies to previously identified sequences.

The determined cDNA sequences of 71 additional breast-specific genes isolated during characterization of breast tumor cDNA libraries are provided in SEQ ID

NO: 210-290. Comparison of these sequences with those in the GenBank and Geneseq databases revealed no significant homologies.

EXAMPLE 2

5 IDENTIFICATION OF BREAST TUMOR PROTEIN cDNAS BY RT-PCR

GABA_A receptor clones were isolated from human breast cancer cDNA libraries by first preparing cDNA libraries from breast tumor samples from different patients as described above. PCR primers were designed based on the GABA_A receptor subunit sequences described by Hedblom and Kirkness (*Jnl. Biol. Chem.* 272:15346-10 15350, 1997) and used to amplify sequences from the breast tumor cDNA libraries by RT-PCR. The determined cDNA sequences of three GABA_A receptor clones are provided in SEQ ID NO: 36-38, with the corresponding amino acid sequences being provided in SEQ ID NO: 39-41.

The clone with the longest open reading frame (ORF; SEQ ID NO: 36) 15 showed homology to the GABA_A receptor of Hedblom and Kirkness, with four potential transmembrane regions at the C-terminal part of the protein, while the clones of SEQ ID NO: 37 and 38 retained either no transmembrane region or only the first transmembrane region. Some patients were found to have only the clones with the shorter ORFs while others had both the clones with longer and shorter ORFs.

20

EXAMPLE 3

EXPRESSION OF OVARIAN TUMOR-DERIVED ANTIGENS IN BREAST

Isolation of the antigens O772P and O8E from ovarian tumor tissue is 25 described in US Patent Application No. 09/338,933, filed June 23, 1999. The determined cDNA sequence for O772P is provided in SEQ ID NO: 205, with the corresponding amino acid sequence being provided in SEQ ID NO: 206. The full-length cDNA sequence for O8E is provided in SEQ ID NO: 207. Two protein sequences may be translated from the full length O8E. Form "A" (SEQ ID NO: 208)

begins with a putative start methionine. A second form "B" (SEQ ID NO: 209) includes 27 additional upstream residues to the 5' end of the nucleotide sequence.

The expression levels of O772P and O8E in a variety of tumor and normal tissues, including metastatic breast tumors, were analyzed by real time PCR.

5 Both genes were found to have increased mRNA expression in 30-50% of breast tumors. For O772P, elevated expression was also observed in normal trachea, ureter, uterus and ovary. For O8E, elevated expression was also observed in normal trachea, kidney and ovary. Additional analysis employing a panel of tumor cell lines demonstrated increased expression of O8E in the breast tumor cell lines SKBR3, MDA-

10 MB-415 and BT474, and increased expression of O772P in SKBR3. Collectively, the data indicate that O772P and O8E may be useful in the diagnosis and therapy of breast cancer.

EXAMPLE 4

15 SYNTHESIS OF POLYPEPTIDES

Polypeptides may be synthesized on a Perkin Elmer/Applied Biosystems Division 430A peptide synthesizer using Fmoc chemistry with HPTU (O-Benzotriazole-N,N,N',N'-tetramethyluronium hexafluorophosphate) activation. A Gly-Cys-Gly sequence may be attached to the amino terminus of the peptide to provide a

20 method of conjugation, binding to an immobilized surface, or labeling of the peptide. Cleavage of the peptides from the solid support may be carried out using the following cleavage mixture: trifluoroacetic acid:ethanedithiol:thioanisole:water:phenol (40:1:2:2:3). After cleaving for 2 hours, the peptides may be precipitated in cold methyl-t-butyl-ether. The peptide pellets may then be dissolved in water containing

25 0.1% trifluoroacetic acid (TFA) and lyophilized prior to purification by C18 reverse phase HPLC. A gradient of 0%-60% acetonitrile (containing 0.1% TFA) in water (containing 0.1% TFA) may be used to elute the peptides. Following lyophilization of the pure fractions, the peptides may be characterized using electrospray or other types of mass spectrometry and by amino acid analysis.

30

From the foregoing it will be appreciated that, although specific embodiments of the invention have been described herein for purposes of illustration, various modifications may be made without deviating from the spirit and scope of the invention. Accordingly, the invention is not limited except as by the appended claims.

CLAIMS

1. An isolated polypeptide, comprising at least an immunogenic portion of a breast tumor protein, or a variant thereof that differs in one or more substitutions, deletions, additions and/or insertions such that the ability of the variant to react with antigen-specific antisera is not substantially diminished, wherein the tumor protein comprises an amino acid sequence that is encoded by a polynucleotide sequence selected from the group consisting of:

(a) sequences recited in SEQ ID NOs: 2-5, 7, 10, 13, 15, 16, 21, 22, 25, 28, 30, 33, 35, 63, 72, 73, 81, 103, 104, 107, 109, 118, 128, 129, 134, 136, 159-161, 164, 181, 183-204 and 210-290;

(b) sequences that hybridize to a sequence recited in any one of SEQ ID NOs: 2-5, 7, 10, 13, 15, 16, 21, 22, 25, 28, 30, 33, 35, 63, 72, 73, 81, 103, 104, 107, 109, 118, 128, 129, 134, 136, 159-161, 164, 181, 183-204 and 210-290 under moderately stringent conditions; and

(c) complements of sequences of (a) or (b).

2. An isolated polypeptide according to claim 1, wherein the polypeptide comprises an amino acid sequence that is encoded by a polynucleotide sequence recited in any one of SEQ ID NOs: 2-5, 7, 10, 13, 15, 16, 21, 22, 25, 28, 30, 33, 35, 63, 72, 73, 81, 103, 104, 107, 109, 118, 128, 129, 134, 136, 159-161, 164, 181, 183-204 and 210-290 or a complement of any of the foregoing polynucleotide sequences.

3. An isolated polynucleotide encoding at least 15 amino acid residues of a breast tumor protein, or a variant thereof that differs in one or more substitutions, deletions, additions and/or insertions such that the ability of the variant to react with antigen-specific antisera is not substantially diminished, wherein the tumor protein comprises an amino acid sequence that is encoded by a polynucleotide comprising a sequence recited in any one of SEQ ID NOs: 2-5, 7, 10, 13, 15, 16, 21, 22,

25, 28, 30, 33, 35, 63, 72, 73, 81, 103, 104, 107, 109, 118, 128, 129, 134, 136, 159-161, 164, 181, 183-204 and 210-290 or a complement of any of the foregoing sequences.

4. An isolated polynucleotide encoding a breast tumor protein, or a variant thereof, wherein the tumor protein comprises an amino acid sequence that is encoded by a polynucleotide comprising a sequence recited in any one of SEQ ID NOs: 2-5, 7, 10, 13, 15, 16, 21, 22, 25, 28, 30, 33, 35, 63, 72, 73, 81, 103, 104, 107, 109, 118, 128, 129, 134, 136, 159-161, 164, 181, 183-204 and 210-290 or a complement of any of the foregoing sequences.

5. An isolated polynucleotide, comprising a sequence recited in any one of SEQ ID NOs: 2-5, 7, 10, 13, 15, 16, 21, 22, 25, 28, 30, 33, 35, 63, 72, 73, 81, 103, 104, 107, 109, 118, 128, 129, 134, 136, 159-161, 164, 181, 183-204 and 210-290.

6. An isolated polynucleotide, comprising a sequence that hybridizes to a sequence recited in any one of SEQ ID NOs: 2-5, 7, 10, 13, 15, 16, 21, 22, 25, 28, 30, 33, 35, 63, 72, 73, 81, 103, 104, 107, 109, 118, 128, 129, 134, 136, 159-161, 164, 181, 183-204 and 210-290 under moderately stringent conditions.

7. An isolated polynucleotide complementary to a polynucleotide according to any one of claims 3-6.

8. An expression vector, comprising a polynucleotide according to any one of claims 3-7.

9. A host cell transformed or transfected with an expression vector according to claim 8.

10. An isolated antibody, or antigen-binding fragment thereof, that specifically binds to a breast tumor protein that comprises an amino acid sequence that is encoded by a polynucleotide sequence recited in any one of SEQ ID NOs: 2-5, 7, 10, 13, 15, 16, 21, 22, 25, 28, 30, 33, 35, 63, 72, 73, 81, 103, 104, 107, 109, 118, 128, 129,

134, 136, 159-161, 164, 181, 183-204 and 210-290 or a complement of any of the foregoing polynucleotide sequences.

11. A fusion protein, comprising at least one polypeptide according to claim 1.

12. A fusion protein according to claim 11, wherein the fusion protein comprises an expression enhancer that increases expression of the fusion protein in a host cell transfected with a polynucleotide encoding the fusion protein.

13. A fusion protein according to claim 11, wherein the fusion protein comprises a T helper epitope that is not present within the polypeptide of claim 1.

14. A fusion protein according to claim 11, wherein the fusion protein comprises an affinity tag.

15. An isolated polynucleotide encoding a fusion protein according to claim 11.

16. A pharmaceutical composition, comprising a physiologically acceptable carrier and at least one component selected from the group consisting of:

- (a) a polypeptide according to claim 1;
- (b) a polynucleotide according to claim 3;
- (c) an antibody according to claim 10;
- (d) a fusion protein according to claim 11; and
- (e) a polynucleotide according to claim 15.

17. A vaccine comprising an immunostimulant and at least one component selected from the group consisting of:

- (a) a polypeptide according to claim 1;

- (b) a polynucleotide according to claim 3;
- (c) an antibody according to claim 10;
- (d) a fusion protein according to claim 11; and
- (e) a polynucleotide according to claim 15.

18. A vaccine according to claim 17, wherein the immunostimulant is an adjuvant.

19. A vaccine according to any claim 17, wherein the immunostimulant induces a predominantly Type I response.

20. A method for inhibiting the development of a cancer in a patient, comprising administering to a patient an effective amount of a pharmaceutical composition according to claim 16.

21. A method for inhibiting the development of a cancer in a patient, comprising administering to a patient an effective amount of a vaccine according to claim 17.

22. A pharmaceutical composition comprising an antigen-presenting cell that expresses a polypeptide according to claim 1, in combination with a pharmaceutically acceptable carrier or excipient.

23. A pharmaceutical composition according to claim 22, wherein the antigen presenting cell is a dendritic cell or a macrophage.

24. A vaccine comprising an antigen-presenting cell that expresses a polypeptide comprising at least an immunogenic portion of a breast tumor protein, or a variant thereof, wherein the tumor protein comprises an amino acid sequence that is encoded by a polynucleotide sequence selected from the group consisting of:

(a) sequences recited in SEQ ID NOs: 1-38, 42-204, 205, 207 and 210-290;

(b) sequences that hybridize to a sequence recited in any one of SEQ ID NOs: 1-38, 42-204, 205, 207 and 210-290 under moderately stringent conditions; and

(c) complements of sequences of (i) or (ii);
in combination with an immunostimulant.

25. A vaccine according to claim 24, wherein the immunostimulant is an adjuvant.

26. A vaccine according to claim 24, wherein the immunostimulant induces a predominantly Type I response.

27. A vaccine according to claim 24, wherein the antigen-presenting cell is a dendritic cell.

28. A method for inhibiting the development of a cancer in a patient, comprising administering to a patient an effective amount of an antigen-presenting cell that expresses a polypeptide comprising at least an immunogenic portion of a breast tumor protein, or a variant thereof, wherein the tumor protein comprises an amino acid sequence that is encoded by a polynucleotide sequence selected from the group consisting of:

(a) sequences recited in SEQ ID NOs: 1-38, 42-204, 205, 207 and 210-290;

(b) sequences that hybridize to a sequence recited in any one of SEQ ID NOs: 1-38, 42-204, 205, 207 and 210-290 under moderately stringent conditions; and

(c) complements of sequences of (i) or (ii) encoded by a polynucleotide recited in any one of SEQ ID NOs: 1-38, 42-204, 205, 207 and 210-290;
and thereby inhibiting the development of a cancer in the patient.

29. A method according to claim 28, wherein the antigen-presenting cell is a dendritic cell.

30. A method according to any one of claims 20, 21 and 28, wherein the cancer is breast cancer.

31. A method for removing tumor cells from a biological sample, comprising contacting a biological sample with T cells that specifically react with a breast tumor protein, wherein the tumor protein comprises an amino acid sequence that is encoded by a polynucleotide sequence selected from the group consisting of:

(i) polynucleotides recited in any one of SEQ ID NOs: 1-38, 42-204, 205, 207 and 210-290; and

(ii) complements of the foregoing polynucleotides;

wherein the step of contacting is performed under conditions and for a time sufficient to permit the removal of cells expressing the antigen from the sample.

32. A method according to claim 31, wherein the biological sample is blood or a fraction thereof.

33. A method for inhibiting the development of a cancer in a patient, comprising administering to a patient a biological sample treated according to the method of claim 31.

34. A method for stimulating and/or expanding T cells specific for a breast tumor protein, comprising contacting T cells with at least one component selected from the group consisting of:

(a) polypeptides comprising at least an immunogenic portion of a breast tumor protein, or a variant thereof, wherein the tumor protein comprises an amino acid sequence that is encoded by a polynucleotide sequence selected from the group consisting of:

- (i) sequences recited in SEQ ID NOs: 1-38, 42-204, 205, 207 and 210-290;
 - (ii) sequences that hybridize to a sequence recited in any one of SEQ ID NOs: 1-38, 42-204, 205, 207 and 210-290 under moderately stringent conditions; and
 - (iii) complements of sequences of (i) or (ii);
- (b) polynucleotides encoding a polypeptide of (a); and
 - (c) antigen presenting cells that express a polypeptide of (a);
- under conditions and for a time sufficient to permit the stimulation and/or expansion of T cells.

35. An isolated T cell population, comprising T cells prepared according to the method of claim 34.

36. A method for inhibiting the development of a cancer in a patient, comprising administering to a patient an effective amount of a T cell population according to claim 35.

37. A method for inhibiting the development of a cancer in a patient, comprising the steps of:

(a) incubating CD4⁺ and/or CD8⁺ T cells isolated from a patient with at least one component selected from the group consisting of:

(i) polypeptides comprising at least an immunogenic portion of a breast tumor protein, or a variant thereof, wherein the tumor protein comprises an amino acid sequence that is encoded by a polynucleotide sequence selected from the group consisting of:

(1) sequences recited in SEQ ID NOs: 1-38, 42-204, 205, 207 and 210-290;

(2) sequences that hybridize to a sequence recited in any one of SEQ ID NOs: 1-38, 42-204, 205, 207 and 210-290 under moderately stringent conditions; and

- (3) complements of sequences of (1) or (2);
- (ii) polynucleotides encoding a polypeptide of (i); and
- (iii) antigen presenting cells that expresses a polypeptide of (i);

such that T cells proliferate; and

(b) administering to the patient an effective amount of the proliferated T cells, and thereby inhibiting the development of a cancer in the patient.

38. A method for inhibiting the development of a cancer in a patient, comprising the steps of:

(a) incubating CD4⁺ and/or CD8⁺ T cells isolated from a patient with at least one component selected from the group consisting of:

(i) polypeptides comprising at least an immunogenic portion of a breast tumor protein, or a variant thereof, wherein the tumor protein comprises an amino acid sequence that is encoded by a polynucleotide sequence selected from the group consisting of:

(1) sequences recited in SEQ ID NOs: 1-38, 42-204, 205, 207 and 210-290;

(2) sequences that hybridize to a sequence recited in any one of SEQ ID NOs: 1-38, 42-204, 205, 207 and 210-290 under moderately stringent conditions; and

(3) complements of sequences of (1) or (2);

(ii) polynucleotides encoding a polypeptide of (i); and

(iii) antigen presenting cells that express a polypeptide of (i);

such that T cells proliferate;

(b) cloning at least one proliferated cell to provide cloned T cells;

and

(c) administering to the patient an effective amount of the cloned T cells, and thereby inhibiting the development of a cancer in the patient.

39. A method for determining the presence or absence of a cancer in a patient, comprising the steps of:

(a) contacting a biological sample obtained from a patient with a binding agent that binds to a breast tumor protein, wherein the tumor protein comprises an amino acid sequence that is encoded by a polynucleotide sequence recited in any one of SEQ ID NOs: 1-38, 42-204, 205, 207 and 210-290 or a complement of any of the foregoing polynucleotide sequences;

(b) detecting in the sample an amount of polypeptide that binds to the binding agent; and

(c) comparing the amount of polypeptide to a predetermined cut-off value, and therefrom determining the presence or absence of a cancer in the patient.

40. A method according to claim 39, wherein the binding agent is an antibody.

41. A method according to claim 40, wherein the antibody is a monoclonal antibody.

42. A method according to claim 40, wherein the cancer is breast cancer.

43. A method for monitoring the progression of a cancer in a patient, comprising the steps of:

(a) contacting a biological sample obtained from a patient at a first point in time with a binding agent that binds to a breast tumor protein, wherein the tumor protein comprises an amino acid sequence that is encoded by a polynucleotide sequence recited in any one of SEQ ID NOs: 1-38, 42-204, 205, 207 and 210-290 or a complement of any of the foregoing polynucleotide sequences;

(b) detecting in the sample an amount of polypeptide that binds to the binding agent;

(c) repeating steps (a) and (b) using a biological sample obtained from the patient at a subsequent point in time; and

(d) comparing the amount of polypeptide detected in step (c) to the amount detected in step (b) and therefrom monitoring the progression of the cancer in the patient.

44. A method according to claim 43, wherein the binding agent is an antibody.

45. A method according to claim 44, wherein the antibody is a monoclonal antibody.

46. A method according to claim 43, wherein the cancer is a breast cancer.

47. A method for determining the presence or absence of a cancer in a patient, comprising the steps of:

(a) contacting a biological sample obtained from a patient with an oligonucleotide that hybridizes to a polynucleotide that encodes a breast tumor protein, wherein the tumor protein comprises an amino acid sequence that is encoded by a polynucleotide sequence recited in any one of SEQ ID NO: 1-38, 42-204, 205, 207 and 210-290 or a complement of any of the foregoing polynucleotide sequences;

(b) detecting in the sample an amount of a polynucleotide that hybridizes to the oligonucleotide; and

(c) comparing the amount of polynucleotide that hybridizes to the oligonucleotide to a predetermined cut-off value, and therefrom determining the presence or absence of a cancer in the patient.

48. A method according to claim 47, wherein the amount of polynucleotide that hybridizes to the oligonucleotide is determined using a polymerase chain reaction.

49. A method according to claim 47, wherein the amount of polynucleotide that hybridizes to the oligonucleotide is determined using a hybridization assay.

50. A method for monitoring the progression of a cancer in a patient, comprising the steps of:

(a) contacting a biological sample obtained from a patient with an oligonucleotide that hybridizes to a polynucleotide that encodes a breast tumor protein, wherein the tumor protein comprises an amino acid sequence that is encoded by a polynucleotide sequence recited in any one of SEQ ID NO: 1-38, 42-204, 205, 207 and 210-290 or a complement of any of the foregoing polynucleotide sequences;

(b) detecting in the sample an amount of a polynucleotide that hybridizes to the oligonucleotide;

(c) repeating steps (a) and (b) using a biological sample obtained from the patient at a subsequent point in time; and

(d) comparing the amount of polynucleotide detected in step (c) to the amount detected in step (b) and therefrom monitoring the progression of the cancer in the patient.

51. A method according to claim 50, wherein the amount of polynucleotide that hybridizes to the oligonucleotide is determined using a polymerase chain reaction.

52. A method according to claim 50, wherein the amount of polynucleotide that hybridizes to the oligonucleotide is determined using a hybridization assay.

53. A diagnostic kit, comprising:

(a) one or more antibodies according to claim 10; and

(b) a detection reagent comprising a reporter group.

54. A kit according to claim 53, wherein the antibodies are immobilized on a solid support.

55. A kit according to claim 53, wherein the detection reagent comprises an anti-immunoglobulin, protein G, protein A or lectin.

56. A kit according to claim 53, wherein the reporter group is selected from the group consisting of radioisotopes, fluorescent groups, luminescent groups, enzymes, biotin and dye particles.

57. An oligonucleotide comprising 10 to 40 contiguous nucleotides that hybridize under moderately stringent conditions to a polynucleotide that encodes a breast tumor protein, wherein the tumor protein comprises an amino acid sequence that is encoded by a polynucleotide sequence recited in any one of SEQ ID NOs: 2-5, 7, 10, 13, 15, 16, 21, 22, 25, 28, 30, 33, 35, 63, 72, 73, 81, 103, 104, 107, 109, 118, 128, 129, 134, 136, 159-161, 164, 181, 183-204 and 210-290 or a complement of any of the foregoing polynucleotides.

58. A oligonucleotide according to claim 57, wherein the oligonucleotide comprises 10-40 contiguous nucleotides recited in any one of SEQ ID NOs: 2-5, 7, 10, 13, 15, 16, 21, 22, 25, 28, 30, 33, 35, 63, 72, 73, 81, 103, 104, 107, 109, 118, 128, 129, 134, 136, 159-161, 164, 181, 183-204 and 210-290.

59. A diagnostic kit, comprising:
(a) an oligonucleotide according to claim 58; and
(b) a diagnostic reagent for use in a polymerase chain reaction or hybridization assay.

SEQUENCE LISTING

<110> Corixa Corporation
Dillon, Davin C.
Day, Craig H.
Jiang, Yuqiu
Wang, Aijun
Houghton, Raymond L.
Mitcham, Jennifer L.

<120> COMPOSITIONS AND METHODS FOR THERAPY AND
DIAGNOSIS OF BREAST CANCER

<130> 210121.491PC

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| attgttttc | caatatcaa | caagtcaa | ttggaaaagg | cataaatctg | tatgaacatc | 180 |
| ctgtatccat | ggagatgt | tgactaaat | cagaaatagc | ctcatctctc | tttgtttttg | 240 |
| ctttcttatg | tctgagtt | gcatccaat | ctgtttatta | catagttttc | tataagattg | 300 |
| tacctcttt | aaacagtgt | tattgatata | tattctaggt | gtctggaagt | ctttttctat | 360 |
| agtcggctct | tggttgtct | tgggaatat | aatggaagga | gcagagtga | aataaatctg | 420 |
| agggcaatat | tcataaata | tccaagagct | acactgtagt | caactctccc | cagagcctga | 480 |
| ccacagtgtt | tcctctctc | ctcctcccaa | cc | | | 512 |

<210> 10

<211> 308
 <212> DNA
 <213> Homo sapien

<220>
 <221> misc_feature
 <222> (1) ... (308)
 <223> n = A,T,C or G

<400> 10
 atgtttatga agacctttaa atatttatat agaaacaaaa tgtcattgca acctaacatc 60
 atccattaaa aataaaagga aaggaaaacg gcagggaata gtgcagtaac aacaaatggt 120
 gacatgcttg gtcttaagca tcatagcaaa ctcattattt ccaatgaaac aaggattttt 180
 agacccatct ttggaaatga ttcccaaatt aganaacct caggtctcaa aaaaggaagg 240
 gtcacaaaag tccatccagc ccagccacc tgaggngcct gtatctcctc aacaagccca 300
 acacaatg 308

<210> 11
 <211> 510
 <212> DNA
 <213> Homo sapien

<220>
 <221> misc_feature
 <222> (1) ... (510)
 <223> n = A,T,C or G

<400> 11
 attatatgaa tattttaatg caaaatgctt aacacttaaa attagcaaag cgtcatttaa 60
 attaaaattc catttaacta aagatgggta accccaanaa attgtacagt agttgatttc 120
 tgctatataa tgccagtcct atgccataca ataagaactg caacattagc tgtcacttcc 180
 tccattgctc ttctggacct taagggatga gggaggggac tcagacacaa aacacaaccc 240
 aaataaactg tgcagtgatt cctaatagtt ataaacccaa tctaagttgt ccaaacagct 300
 gaagaataac tgcaggtatt gttccanagc tgatacgagg ttttgctttt acagcctggt 360
 aaaagtctg cactaggtga gaagtcacag tttaaggatg catgttctgt aaatagttac 420
 tacatatata catttactgt ctgtaaacac tagaaatata cattagacag agtaccctca 480
 caagttgggt acagttttaa aaagaagatg 510

<210> 12
 <211> 611
 <212> DNA
 <213> Homo sapien

<220>
 <221> misc_feature
 <222> (1) ... (611)
 <223> n = A,T,C or G

<400> 12
 agttttataa aatattttat ttacagtaga gctttacaaa aatagtctta aattaatata 60
 aatccctttt gcaatataac ttatatgact atcttctcaa aaacgtgaca ttcgattata 120
 acacataaac tacatttata gttgttaagt cacctttagt tataaatatg ttttcatctt 180
 ttttttga taaggnacat accaataaca atgaacaatg gacaacaaat cttattttgt 240
 tattcttcca atgtaaaatt catctctggc caaaacaaaa ttaaccaaag aaaagtaaaa 300
 caattgtccc tctgttcaac aatacagtc tttttaatta tttgagagtt tatctgacag 360
 agacacagca ttaaactgaa agcaccatgg cataaagtct agtaacatta tcctcaaaaag 420
 ctttttccaa tgtctttcct tcaactgttt attcagtatt tggccagtac aaataaagat 480
 tgggtctcaac tctctctttc attagtctca agtgttctta ttatgactg agttttcaga 540

ccttcccaac tggcatgtgt ttttaagtgtg agtttctttc tttggcttca agtggagttt 600
cacaacattt a 611

<210> 13
<211> 394
<212> DNA
<213> Homo sapien

<220>
<221> misc_feature
<222> (1)...(394)
<223> n = A,T,C or G

<400> 13
caatgttttag attcatttta ttagtggcat atacaaagca ccatataata tatgaaacgt 60
anaacaatca tgactatgta attaactgta naaataactg ctaanaaaat atagcaatat 120
ttaacacagg atttctaaaa ccattatatt ttcattactt tccccaaagc taatgtccca 180
tgttttatatt tatanacttt gtttatcaag atttatatgc atttggcacc tttttgggct 240
gaaaatagtt gatgtactct gtacagtaat gttacagttt tatacaaaat tcanaaatat 300
tgcatttggga atagtcttta tggtcctctt ccaagtattc agtttcacac aacagcaaac 360
actctgaatg cctttcctcc tgcccaacac aatg 394

<210> 14
<211> 361
<212> DNA
<213> Homo sapien

<220>
<221> misc_feature
<222> (1)...(361)
<223> n = A,T,C or G

<400> 14
agcaggact ataattttat aattaatttt acaattcatg tagcaaatgg aaaatcatac 60
agagaggcca atgtatataa ataagagttt atacagaaac tgccaattca caaaacagca 120
ctgcatgggt tctatattgc aagcacaaga catggtcaca tggttccact gtacaggtag 180
aaacaagccc acagacaata catagagtac cacctgaaac gaggcccttg gagctgctca 240
gcttcttana aaataganaa ctttcaatgg tcataatata ttttgattca aaatgtcttc 300
taaaatgttt tcattgtggg agaaaattaa gaaggggcaa aaatccatct atggaacttc 360
t 361

<210> 15
<211> 537
<212> DNA
<213> Homo sapien

<220>
<221> misc_feature
<222> (1)...(537)
<223> n = A,T,C or G

<400> 15
acttacaaaa ttaattttat tttgcaaaac tcaacaaata cacgttcaga tctggtttct 60
cttcaaaaaca tgtgtttgtt tttttaacaa acatgcaagt taatttggca tgccaaacat 120
ctttctctct agctcgctt ggaaaaattt ttttcataac acaacaagg gtgcaaatat 180
tgtccaaacc tatttacatt ttaccctct agaattacat acattaatat ttattgggag 240
gaaagcaaaa ctgcaaaaaca tagtctttgg cattcacatt tgcttcagca gtataattaa 300
aaccttatat ttgttttaaa gataaacagt ttgaaggaaa ttttaataaat cttgttttgg 360

```

ctctgcaaag gagccactat atcaaagcat ttaactggag ctgttgagtt cctgctggta      420
gaatattact tccagcctat ttattagctt gtcttcggn ggcccaatac atgctttttt      480
ccctctacac tgaatgaaag tacaaaaaga aaaccatttc ttttcccaa cacaatg        537

```

```

<210> 16
<211> 547
<212> DNA
<213> Homo sapien

<220>
<221> misc_feature
<222> (1) ... (547)
<223> n = A,T,C or G

```

```

<400> 16
gggtgtggng atgtatttat tcataatata ttttcagaac acattaataa tggagaataa      60
cacttattca tatactgaat ataacttttc ctggagcact ctagagcttg tttggagttg     120
gagaatactg ccaggctttt cctaattctt ttggtctttg gaagtgggca gggtttctca     180
aaccaagtgt cttccatggg ccattggcaa aggcctccct tcatcagctt ggaggggagc     240
aaagaccatg gcttcagcac ttccattttg gaaagaagta acaaaaaagt gaattaatga     300
gcaatcggaa agactcaaag cattttgtac tccacagttc atttcttcac acaaacgtcc     360
attactgcag cgggcatgaa aaccggcagg gtgttaggct catggcctga agagaagtca     420
catcaccagc cgatgttttc atgcaaaagg caatcgtgat gattcanaac ctggttctga     480
atttctccag gtgtgctcgt gagctgaagg tcatgcccac tctgtgcac cctgtgccaa     540
cacaatg                                           547

```

```

<210> 17
<211> 342
<212> DNA
<213> Homo sapien

```

```

<400> 17
acattaagaa gctcctcttc tagcatgtcc ttaagaagcc tgtcttgag cactttcata      60
tcttctttca tcaaacacat ctcgatgta aaaacagttt cttcactatc agtattacag     120
aagacacttt tagccaatga agttttcaaa agaagaaagc ctctgttgtt cgcttttttg     180
atatgcactg aacttctgaa atatcttttc ccaaaagtcc acaaattcct tttccaaatc     240
ttttaaagac tgtgaatctt tttcaaaatt ctccagctcc tctatgataa tgaattggaa     300
tttatcaagt tttttaatcc tagagtctctg actttggatg at                                           342

```

```

<210> 18
<211> 279
<212> DNA
<213> Homo sapien

```

```

<400> 18
catcataagg ttttattcat atatatacag ggtattaaga attaagagga tgctgggctc      60
tgttcttggc ttggaagatt ctatttaatt gaaactctct gttcagaaag caataacttt     120
gtctcgttcc tgttgggctg aaccctaagg tgagtgtgca gtacagtgtg tgtgggtgaa     180
atggagattt ggaattgaac tctctgcctg taaatgttcc ccaaataatt gttgtgtgta     240
tgatacgtgt ataataaaag tattcttggt agaattctga                                           279

```

```

<210> 19
<211> 239
<212> DNA
<213> Homo sapien

```

```

<400> 19
ctgccagcgt ttttgtgtgg ctgcagtgtg cctgggccca gctcacgggc agtgggtgga      60

```

| | | | | | | |
|------------|------------|------------|------------|-------------|------------|-----|
| cctaactgcc | caggcaggcg | agagctactt | ccagagcctt | ccagtgcattg | ggagggcagg | 120 |
| gctaggtgta | gcggtgtctc | ctctttgaaa | ttaagaacta | tctttcttgt | agcaaagctg | 180 |
| cacctgatga | tgtctcctct | cctctctgtg | ttgtctgggc | ccttgtttac | aagcacgcg | 239 |

<210> 20
 <211> 527
 <212> DNA
 <213> Homo sapien

| | | | | | | |
|------------|------------|------------|------------|-------------|-------------|-----|
| <400> 20 | | | | | | |
| ctgaaccatt | atgggataaa | ctggtgcaaa | ttctttgcct | tctctacttc | tcaactgattg | 60 |
| aacataagct | tccagggctc | ccctgatgag | gaggagcctg | tcctttttcag | atggatgggtc | 120 |
| atccagccac | tgagagaagc | gtgtgtggga | ccactctgcc | ctctggaaag | gagattttcag | 180 |
| ttcagcgggt | gctctcgtga | acaaaaactg | aataatgatg | ctgaacggaa | tcacatcccc | 240 |
| caatgcagga | ctactggcta | catgttcact | tgcttggaa | agcagagggtc | tgaatgatct | 300 |
| cagcatccga | taggactttc | ctaaatcaga | tactcgtcta | cagaatgaac | ccacagccaa | 360 |
| ctccatctgt | gcaaaatcag | cagcaagtcg | cattttccca | ccttcaccaa | gaggtcttat | 420 |
| gagactggca | tggcggataa | aaagttcaac | agctctttgg | gcaataacct | cagtgttgct | 480 |
| aaagacaaaa | tccaagcatt | caaagtgttt | aaaatagtca | ctcataa | | 527 |

<210> 21
 <211> 399
 <212> DNA
 <213> Homo sapien

| | | | | | | |
|------------|------------|------------|------------|-------------|------------|-----|
| <400> 21 | | | | | | |
| ctgcaatggt | tgcaagtgtc | atttccacct | agctctgact | ctccacttct | aaccagacaa | 60 |
| acagccaacc | aaccaatcaa | catgtattta | ataaccacct | atgggggtgca | aagcacaaaa | 120 |
| gggcactcat | cttgaaaagg | aaagaccaag | aatgtgctag | agtaaagaga | cagagaccag | 180 |
| accctactct | caagatcaag | agacttcagt | ctcggagaca | tctgccattt | ctctcttctt | 240 |
| aataaacctc | atttgccttt | aaaaatacat | ttgctttggg | ggcccagaat | caagaaagga | 300 |
| aacttttaca | agtaaacaga | agttactccc | cacagggagg | cagaagcaga | ttaaccccaa | 360 |
| cagcagacat | ctgcccggaa | gagcaaaact | cacatctgg | | | 399 |

<210> 22
 <211> 532
 <212> DNA
 <213> Homo sapien

| | | | | | | |
|-------------|------------|------------|------------|------------|-------------|-----|
| <400> 22 | | | | | | |
| ccagaagggtg | aagaaaagt | atctgataat | gtctaaagt | cagtagaaat | actttttaacc | 60 |
| attgatgata | caaagagagc | tggaatgaaa | gagctaaaac | gtcatcctct | cttcagtgtat | 120 |
| gtggactggg | aaaatctgca | gcatcagact | atgcctttca | tccccagcc | agatgatgaa | 180 |
| acagatacct | cctattttga | agccaggaat | actgctcagc | acctgaccgt | atctggattt | 240 |
| agtctgtagc | acaaaaat | ttcttttagt | ctagcctcgt | gttatagaat | gaacttgcat | 300 |
| aattatatac | tccttaatac | tagattgatc | taagggggaa | agatcattat | ttaacctagt | 360 |
| tcaatgtgct | tttaatgtac | gttacagctt | tcacagagtt | aaaaggctga | aaggaatata | 420 |
| gtcagtaatt | tatcttaacc | tcaaaactgt | atataaatct | tcaaagcttt | tttcatctat | 480 |
| ttattttgtt | tattgcactt | tatgaaaact | gaagcatcaa | taaaattaga | gg | 532 |

<210> 23
 <211> 215
 <212> DNA
 <213> Homo sapien

| | | | | | | |
|------------|------------|------------|------------|------------|------------|-----|
| <400> 23 | | | | | | |
| tgcaataaag | ggctgtgtgt | tcgacgacac | cgttcgtggg | gtcccctggg | gcttctatcc | 60 |
| taataccatc | gacgtccctc | cagaagagga | gtgtgaattt | tagacacttc | tgccaggatc | 120 |

| | | | | | | |
|------------|------------|------------|-------------|------------|------------|-----|
| tgccctgcac | ctgacacggt | gccgtcccca | gcacgggtgat | tagtcccaga | gctcggctgc | 180 |
| cacctccacc | ggacacctca | gacacgcttc | tgtag | | | 215 |

<210> 24
 <211> 215
 <212> DNA
 <213> Homo sapien

| | | | | | | |
|------------|------------|------------|------------|------------|------------|-----|
| <400> 24 | | | | | | |
| cctgaggctc | caggctaaga | agtagccaag | tttcacctgg | agagaagagt | agagggactt | 60 |
| cccaaatttc | ttcctgaact | cagctctgat | actcagaagg | tcagtctcac | atcgagagat | 120 |
| aaggatgcga | atcaggactt | ggtaattggg | ctcagtttcc | tagtagggga | agaaagagat | 180 |
| ggggggtagt | tagtgagagt | ctcactgaga | gtagg | | | 215 |

<210> 25
 <211> 530
 <212> DNA
 <213> Homo sapien

| | | | | | | |
|------------|-------------|-------------|-------------|-------------|-------------|-----|
| <400> 25 | | | | | | |
| ttttttttct | agtaagacta | gatttattca | ataccctagt | aaaagttttg | attataagta | 60 |
| tccaacagta | taaaaagtac | aaaacagatc | tgtagatttc | taatataatta | atacaaagtg | 120 |
| catgactaca | tacagtacat | cctacaggca | aagagagggtg | gaaggggaaa | aagaagactg | 180 |
| tggttgaggt | ctagtaataa | ataaataaat | acagaagtag | agatgatcca | tattatagta | 240 |
| tattctacca | ccaatactgc | agccaaaatg | tacaaaaaaa | atcattttcaa | ataactcagg | 300 |
| aggatgataa | tggtctggact | tttgtaattc | acctcaaaga | ctgtggggaga | gccaaactcaa | 360 |
| ctcactgtat | agtctgtgca | tatgggtggct | tgtagcatgt | agggttttttc | caaaagaagg | 420 |
| aaatataaaa | tgtttagatt | aagaactata | aaactacagg | gtgcctataa | aagggtggctt | 480 |
| actccttatt | gttattatac | tatccaattt | ttaaaatgca | gtttaaaaaa | | 530 |

<210> 26
 <211> 366
 <212> DNA
 <213> Homo sapien

| | | | | | | |
|------------|------------|------------|------------|-------------|-------------|-----|
| <400> 26 | | | | | | |
| ccagcagttc | tcggacctcc | tctgggggca | gggagaggcc | attgggtcag | gggctggacc | 60 |
| caggaggagt | tggaatgggt | gaaagatggg | gagcaagttt | ttaggggtaca | gggtgggcct | 120 |
| aagatgggtc | agtagacaga | tgggagcaca | gagcagggca | gggggtgagg | tcaagtgagg | 180 |
| gccacaggat | gtgctgaggg | ctcccaggga | gccctaccca | ggctcacgtc | ctcctgggtca | 240 |
| ccacctgtac | tgtctggggg | ccacagggtg | tgggcggttg | cagggagcac | tgggagggcc | 300 |
| tcggtagggg | ccacctgtag | ggagaggatg | tcaggaccac | tagcctcttg | gcaagggcag | 360 |
| aggagg | | | | | | 366 |

<210> 27
 <211> 331
 <212> DNA
 <213> Homo sapien

<220>
 <221> misc_feature
 <222> (1)...(331)
 <223> n = A,T,C or G

| | | | | | | |
|------------|-------------|------------|------------|------------|------------|-----|
| <400> 27 | | | | | | |
| ccaaactcag | agatgggtacc | agccaggggc | aagcatgacc | agagccaggg | accctgtggc | 60 |
| tctgatcccc | catttatcca | ccccatgtgc | ctcaggacta | gagttagcaa | tcatacctta | 120 |
| taaatgactt | ttgtgccttt | ctgctccagt | ctcaaaattt | cctacacctg | ccagttcttt | 180 |

| | | | | | | |
|------------|------------|------------|------------|------------|------------|-----|
| acatttttcc | aaggaaagga | aaacggaagc | agggttcttg | cctggtagct | ccaggaccca | 240 |
| nctctgcagg | cacccaaaga | ccctctgtgt | ccagcctctt | ccttgagttc | tcggaacctc | 300 |
| ctccctaatt | ctcccttctt | tcccacaag | g | | | 331 |

<210> 28
 <211> 530
 <212> DNA
 <213> Homo sapien

| | | | | | | |
|-------------|------------|------------|------------|------------|------------|-----|
| <400> 28 | | | | | | |
| ccatgaatgc | ccaacaagat | aatattctat | accagactgt | tacaggattg | aagaaagatt | 60 |
| tgtcaggagt | tcagaaggtc | cctgcactcc | tagaaaatca | agtggaggaa | aggacttggt | 120 |
| ctgattcaga | agatattgga | agctctgagt | gctctgacac | agattctgaa | gagcagggag | 180 |
| accatgccc | ccccaaagaa | cacaccacgg | accctgacat | tgataaaaaa | gaaagaaaaa | 240 |
| agatgggtcaa | ggaagcccag | agagagaaaa | gaaaaaacia | aattcctaaa | catgtgaaaa | 300 |
| aaagaaaagga | gaagacagcc | aagacgaaaa | aaggcaaata | gaatgagaac | catattatgt | 360 |
| acagtcattt | tcctcagttc | cttttctcgc | ctgaactctt | aagctgcac | tggaagatgg | 420 |
| cttattgggt | ttaaccagat | tgctcatcgt | gcactgtctg | tgaagacgga | ttcaaagtgt | 480 |
| ttcatgtaac | tatgtaaaaa | gctctaagct | ctagagtcta | gatccagtca | | 530 |

<210> 29
 <211> 571
 <212> DNA
 <213> Homo sapien

<220>
 <221> misc_feature
 <222> (1)...(571)
 <223> n = A,T,C or G

| | | | | | | |
|------------|-------------|-------------|------------|-------------|------------|-----|
| <400> 29 | | | | | | |
| ccataatatt | ctgatgatca | aggagcacac | atatacaaaa | gttattggat | tactgcaatt | 60 |
| ctcagaggca | caaaacctga | catgggtgtga | tatagtatat | aatcagtcac | gggggggaaa | 120 |
| agaacattaa | gtcttttaaaa | aggcttagga | agacataaac | agtaaattctt | tgtttttcta | 180 |
| cttctctttg | gacagtgtta | tatttctactt | tcttctttgc | aaaatgtttc | caaattcatt | 240 |
| tgctcaggat | ttattttaaga | taataactta | aaacaactaa | cagttgttta | tgctatatgc | 300 |
| atatcatgca | tgttctactg | gttcaaggac | aaaattaaaa | caagatcttc | tctgtaaagc | 360 |
| aaatataatt | attatgcact | ttcatatata | cagggatttt | ttgagtacca | angggataaa | 420 |
| ataaaaactt | tacaatgtga | aattcaatgt | acatttttgg | ctattttacat | acctcaaacc | 480 |
| aagggaaaaa | taaaaagaaa | gcatttgttt | gcaactacat | ttgctgagaa | gtgtaaattg | 540 |
| aggacattaa | gcaaaaacaaa | tatttgcata | g | | | 571 |

<210> 30
 <211> 917
 <212> DNA
 <213> Homo sapien

| | | | | | | |
|------------|------------|-------------|------------|------------|------------|-----|
| <400> 30 | | | | | | |
| actgccagag | agtatgattt | gaaggagatg | ggagcagatg | taattcttgg | ctggaatctc | 60 |
| tcattttcaa | atcatttcac | ataatggtgt | catcatttaa | acacttaaca | gtcagtgcaa | 120 |
| ctgccactgt | aacatctagt | tggaacaaa | cacaaggagg | gggaggagaa | aatgccatca | 180 |
| ctattatgtt | aacaaacatt | taattttaaat | ggttgctgca | ctagtaaatt | tctgcagaaa | 240 |
| acagttttac | ccgccccctt | tcacagttcc | aaattaatca | aggatgcttt | tctataatct | 300 |
| gatgcttagc | aaattagctc | atgattcaaa | ttttgccctc | ttgaagcaca | tatacctttt | 360 |
| attttaaaag | tccattatag | agaatttgga | atatataagg | tatttgaatt | gcagaacacc | 420 |
| cctctaattc | tgtaaatata | gcaaagacaa | aacagtatca | tatacatcaa | gatcatactt | 480 |
| ttaaagtaag | tttaaaggtc | tcaattgccc | agatattaaa | tttatatttt | ccttctatta | 540 |
| aaaaatatta | catttcaatt | ttgtaaatatt | gtaacatatt | ttaagatgac | cagcaagacc | 600 |

```

tagtcaat ttt gaaaataccc ttgcattcca tacacaagct ataccataag taataaccca 660
agtatatgat gtgtaaaaagt tgggtgaagg cataatactg aatttttttg caaatgtaaa 720
ctgctttcca agtaatcagc accatttttt actagactac attttaatca ctcccttagc 780
tgcttacaac ctctacttag gcataaataa aagaatctga aattggtata tttcccttc 840
ctgctgtgtt aaccaaaaat actatttgac ttaaagatca aagagtcttt ttctgaagg 900
ttttgtttt taaatgt 917

```

```

<210> 31
<211> 367
<212> DNA
<213> Homo sapien

```

```

<220>
<221> misc_feature
<222> (1) ... (367)
<223> n = A,T,C or G

```

```

<400> 31
tcttttcttt ctgtatttcc caaattacag ggagctatgc ccttggtatt gcacacagta 60
cactgcaaaa gattcacaaag gttagttgaa agtcattttt gccctggtga ttcaaagctc 120
aaanaatttt ctagcataaa gtcttattaa aaattttaat caaaatatta tttgagttta 180
agttttaataa aacaatacca ctatatatac tctcaacaac ttcattatat aatcagtcct 240
atgaggttgt acttgctttt catatcacac tgattaagga caaaaataat tttgatgtac 300
atgtaccata cactgatatg caatctacac actgatgcat ttacatacat acaaccccaa 360
cacaatg 367

```

```

<210> 32
<211> 847
<212> DNA
<213> Homo sapien

```

```

<400> 32
cattgtgttg ggctggcagg atagaagcag cggctcactt ggactttttc accagggaaa 60
tcagagacaa tgatggggct cttccccaga actacagggg ctctggccat cttcgtggtg 120
agtcctggat tttcctaata atcacaaact tccctgcttc ctcccttggt aaagaatatt 180
atatttgatt gcacaatctt tattataaat tctaaaagga gtgcagtgga aatcaacact 240
ttgaaatgaa atcgtgaaga ttaccaattt ccttcttttg ttgtttttta tgttgtattt 300
tacatagaaa aataaaccag aaagaaatga gttttaaaaa ccatttagaa ttttttttag 360
ttaatgaatt aagtaatctt aatcacaggt tatattttcc acaacatttt cactttcttt 420
aaagttagtc ttttactagt ttttctaacc cacaaacaag aacacaggag ccacttctat 480
tttccaagat tacatgtctc ttagcatata gctaagaact ctacacgcct gggcttgata 540
cctgacacgc ttttaaaagt aaaaaatcgc agaattaaaa tcaaagcagt gtttgactct 600
agagaagttg ggaggattat taagtaagta tttatgttta gctattatgt gccaaaagaa 660
aatgtcagcc tttggggatg gggggaaaga catacaacat tttaaagcca tttttttcag 720
aaaagtaata cttctgttga ttgagaaagt cgtacatagt attatctaaa agagaaacgg 780
aatgttacag actgttttaa acctggatgt tacagactaa cttactcctt aactgtgttc 840
ttatagc 847

```

```

<210> 33
<211> 863
<212> DNA
<213> Homo sapien

```

```

<220>
<221> misc_feature
<222> (1) ... (863)
<223> n = A,T,C or G

```

<400> 33

| | | | | | | |
|------------|-------------|------------|------------|-------------|------------|-----|
| cattgtgttg | ggcttttatt | tgagtttatg | aacagaaata | gaaagtatgg | tgcttggggt | 60 |
| ttgccctttc | ttactcctga | aagttaaatc | agaagacact | gatttcattt | tgtgaaattt | 120 |
| agctcagaga | ctattgatct | tttgtttcat | taatatgaac | aactattagt | aaaaaatagc | 180 |
| tttaacagca | tttctgctga | tatctagtaa | tctattcttt | taatgtgaaa | ataagataaa | 240 |
| atgtcctgga | gctaattcta | gcttaaattt | gccagtattt | ctgtatgtca | ttaagttttt | 300 |
| ttcctctaag | gttggttaata | naattttgtt | aatctttgca | tacctgatgg | catctatgtc | 360 |
| aatgctgatt | gggtaattat | aaattctgtg | ctaattttaa | acttaatttg | cctcttaagg | 420 |
| tgattgtcct | ctgagtaatg | attgtagtta | aatgaagtat | agcttgcaac | tatactatca | 480 |
| catgggtcgt | taagtaaaaa | taaataaacc | aaatttgtct | gagacaggct | aagatcaatc | 540 |
| ttctcatcaa | accaattttt | ctntaagagc | aatttcactt | tcagtttttag | ggtggacatt | 600 |
| nttgaatgcc | tcaaatataa | cgttatctat | ttaatcttcc | tggaatagtc | tgtgacccaa | 660 |
| aaggagggtg | tgatatattt | aggtgtaaat | atatcacata | tatggtgtga | tatatttggg | 720 |
| atttatatat | tcagctcatt | ctctgtgaag | aagtcttcct | gactaaaatt | ggtttcaaga | 780 |
| taaactaatt | tctgttagta | tttctactct | gcctaccatg | tatgcctttt | tgttagaaac | 840 |
| taataaatgt | atcagtcnct | agc | | | | 863 |

<210> 34

<211> 432

<212> DNA

<213> Homo sapien

<400> 34

| | | | | | | |
|------------|------------|-------------|------------|------------|-------------|-----|
| agtgcatctt | ctcttgattt | gtctgggtta | aaaccattcc | ttttgtatga | aatgttttga | 60 |
| cttaggaatc | attttatgta | cttgttctac | ctggattgtc | aacaactgaa | agtacatatt | 120 |
| tcatccaaat | caagctaaaa | tgtattttaag | ttgattctga | gagtacaggt | cagtaagcct | 180 |
| cattatttgg | aatttgagag | aaggatatagg | tgatcggatc | tgtttcattt | ataaaaaggtc | 240 |
| cagtttttag | gactagtaca | ttcctgttat | tttctgggtt | ttatcatttt | gcctaaaata | 300 |
| ggatataaaa | gggacaaaaa | ataagtagac | tgtttttatg | tgtgaattat | atttctacta | 360 |
| aatgtttttg | tatgactgtg | ttatacttga | taatatatat | atatatatat | atatatatca | 420 |
| acttgttaaa | tt | | | | | 432 |

<210> 35

<211> 350

<212> DNA

<213> Homo sapien

<400> 35

| | | | | | | |
|------------|------------|------------|------------|------------|------------|-----|
| ccagaggggt | gtttatctta | gggttggaat | gtttctgatt | atgctgacaa | tagccattag | 60 |
| gctgatgttt | tggggctgga | tttaggcagt | ttttaataaa | aagagaactt | aaaatgggtg | 120 |
| tgtttgtcca | agatgggtat | gttcctgctg | tcaattagca | taaacaaaag | agaattctga | 180 |
| taccctgttg | gaatgtcttc | attcctctga | gcttctccac | tcacaggata | aatgcaggag | 240 |
| tggttcccc | tcatggacac | ctgcaaatgc | agagtgtggg | ggctctcctg | gccctgcac | 300 |
| actagcaaga | gcaaaagctg | ctccgagctc | tgtttttaga | acctggtcga | | 350 |

<210> 36

<211> 1082

<212> DNA

<213> Homo sapien

<400> 36

| | | | | | | |
|------------|------------|------------|------------|-------------|------------|-----|
| atgaactaca | gcctccactt | ggccttcgtg | tgtctgagtc | tcttctactga | gaggatgtgc | 60 |
| atccagggga | gtcagttcaa | cgctgaggtc | ggcagaagtg | acaagctttc | cctgcctggc | 120 |
| tttgagaacc | tcacagcagg | atataacaaa | tttctcaggc | cgaatttttg | tggagaaccc | 180 |
| gtacagatag | cgctgactct | ggacattgca | agtatctcta | gcatttcaga | gagtaacatg | 240 |
| gactacacag | ccaccatata | cctccgacag | cgctggatgg | accagcggct | gggtgttgaa | 300 |
| ggcaacaaga | gcttctactc | ggatgcccg | ctcgtggagt | tcctctgggt | gccagatact | 360 |
| tacattgttg | agtcacaaga | gtccttcctc | catgaagtca | ctgtgggaaa | caggctcatc | 420 |

| | | | | | | |
|-------------|------------|------------|-------------|-------------|------------|------|
| cgccctcttct | ccaatggcac | ggtcctgtat | gccctcagaa | tcacgacaac | tgttgcatgt | 480 |
| aacatggatc | tgtctaaata | ccccatggac | acacagacat | gcaagttgca | gctggaaagc | 540 |
| tggggctatg | atggaaatga | tgtggagttc | acctggctga | gagggaaacga | ctctgtgcgt | 600 |
| ggactggaac | acctgcggct | tgctcagtac | accatagagc | ggatatttcac | cttagtcacc | 660 |
| agatcgcagc | aggagacagg | aaattacact | agattgggtct | tacagtttga | gcttcggagg | 720 |
| aatgttctgt | atttcatttt | ggatctctct | cgattcagtc | cctgcaagaa | cctgcattgg | 780 |
| ggacaacaaa | ggaagtagaa | gaagtcagta | ttactaatat | catcaacagc | tccatctcca | 840 |
| gctttaaacg | gaagatcagc | tttgccagca | ttgaaatttc | cagcgacaac | gttgactaca | 900 |
| gtgacttgac | aatgaaaacc | agcgacaagt | taaagtttgt | cttccgagaa | aagatgggca | 960 |
| ggattgttga | ttatttcaca | attcaaaacc | ccagtaatgt | tgatcactat | tccaaactac | 1020 |
| tgtttctctt | gatttttatg | ctagccaatg | tattttactg | ggcatactac | atgtattttt | 1080 |
| ga | | | | | | 1082 |

<210> 37
 <211> 1135
 <212> DNA
 <213> Homo sapien

| | | | | | | |
|-------------|------------|------------|-------------|-------------|------------|------|
| <400> 37 | | | | | | |
| atgaactaca | gcctccactt | ggccttcgtg | tgtctgagtc | tcttcactga | gaggatgtgc | 60 |
| atccagggga | gtcagttcaa | cgtcgaggtc | ggcagaagtg | acaagctttc | cctgcctggc | 120 |
| tttgagaacc | tcacagcagg | atataacaaa | tttctcaggc | ccaatttttg | tggagaaccc | 180 |
| gtacagatag | cgctgactct | ggacattgca | agtatctcta | gcatttcaga | gagtaacatg | 240 |
| gactacacag | ccaccatata | cctccgacag | cgctggatgg | accagcggct | ggtgtttgaa | 300 |
| ggcaacaaga | gcttcactct | ggatgcccgc | ctcgtggagt | tcctctgggt | gccagatact | 360 |
| tacattgtgg | agtccaagaa | gtccttcctc | catgaagtca | ctgtgggaaa | caggctcatc | 420 |
| cgccctcttct | ccaatggcac | ggtcctgtat | gccctcagaa | tcacgacaac | tgttgcatgt | 480 |
| aacatggatc | tgtctaaata | ccccatggac | acacagacat | gcaagttgca | gctggaaagc | 540 |
| tggggctatg | atggaaatga | tgtggagttc | acctggctga | gagggaaacga | ctctgtgcgt | 600 |
| ggactggaac | acctgcggct | tgctcagtac | accatagagc | ggatatttcac | cttagtcacc | 660 |
| agatcgcagc | aggagacagg | aaattacact | agattgggtct | tacagtttga | gcttcggagg | 720 |
| aatgttctgt | atttcatttt | ggaaacctac | gttccttcca | ctttcctggg | ggtgttgtcc | 780 |
| tgggtttcat | tttgatctct | tctcgattca | gtccctgcaa | gaacccgcat | tggggacaac | 840 |
| aaaggaagta | gaagaagtca | gtattactaa | tatcatcaac | agctccatct | ccagctttaa | 900 |
| acggaagatc | agctttgcca | gcattgaaat | ttccagcgac | aacgttgact | acagtgaact | 960 |
| gacgaatgaa | accagcgaca | agttaaagtt | tgtcttcgga | gaaaagatgg | gcaggattgt | 1020 |
| tgattatttc | acaattcaaa | accccagtaa | tgttgatcac | tattccaaac | tactgtttcc | 1080 |
| tttgattttt | atgctagcca | atgtatttta | ctgggcatcc | tacatgtatt | tttga | 1135 |

<210> 38
 <211> 1323
 <212> DNA
 <213> Homo sapien

| | | | | | | |
|-------------|------------|------------|-------------|-------------|------------|-----|
| <400> 38 | | | | | | |
| atgaactaca | gcctccactt | ggccttcgtg | tgtctgagtc | tcttcactga | gaggatgtgc | 60 |
| atccagggga | gtcagttcaa | cgtcgaggtc | ggcagaagtg | acaagctttc | cctgcctggc | 120 |
| tttgagaacc | tcacagcagg | atataacaaa | tttctcaggc | ccaatttttg | tggagaaccc | 180 |
| gtacagatag | cgctgactct | ggacattgca | agtatctcta | gcatttcaga | gagtaacatg | 240 |
| gactacacag | ccaccatata | cctccgacag | cgctggatgg | accagcggct | ggtgtttgaa | 300 |
| ggcaacaaga | gcttcactct | ggatgcccgc | ctcgtggagt | tcctctgggt | gccagatact | 360 |
| tacattgtgg | agtccaagaa | gtccttcctc | catgaagtca | ctgtgggaaa | caggctcatc | 420 |
| cgccctcttct | ccaatggcac | ggtcctgtat | gccctcagaa | tcacgacaac | tgttgcatgt | 480 |
| aacatggatc | tgtctaaata | ccccatggac | acacagacat | gcaagttgca | gctggaaagc | 540 |
| tggggctatg | atggaaatga | tgtggagttc | acctggctga | gagggaaacga | ctctgtgcgt | 600 |
| ggactggaac | acctgcggct | tgctcagtac | accatagagc | ggatatttcac | cttagtcacc | 660 |
| agatcgcagc | aggagacagg | aaattacact | agattgggtct | tacagtttga | gcttcggagg | 720 |
| aatgttctgt | atttcatttt | ggaaacctac | gttccttcca | ctttcctggg | ggtgttgtcc | 780 |


```

tgggtttcat tttggatctc tctcgattca gtccctgcaa gaacctgcat tggagtgcacg      840
accgtgttat caatgaccac actgatgacg gggccccgca cttctcttcc caacaccaac      900
tgcttcatca aggccatcga tgtgtacctg gggatctgct ttagctttgt gtttggggcc      960
ttgctagaat atgcagttgc tctactacagc tccttacagc agatggcagc caaagatagg     1020
gggacaacaa aggaagtaga agaagtcagt attactaata tcatcaacag ctccatctcc     1080
agctttaaac ggaagatcag ctttgccagc attgaaattt ccagcgacaa cgttgactac     1140
agtgaactga caatgaaaac cagcgacaag ttcaagtttg tcttccgaga aaagatgggc     1200
aggattgttg attatttcac aattcaaaac ccagtaatg ttgatcacta ttccaaacta     1260
ctgtttcctt tgatttttat gctagccaat gtattttact gggcatacta catgtatttt     1320
tga                                                                    1323

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```

<210> 39
<211> 440
<212> PRT
<213> Homo sapien

```

```

<400> 39
Met Asn Tyr Ser Leu His Leu Ala Phe Val Cys Leu Ser Leu Phe Thr
 1          5          10          15
Glu Arg Met Cys Ile Gln Gly Ser Gln Phe Asn Val Glu Val Gly Arg
 20          25          30
Ser Asp Lys Leu Ser Leu Pro Gly Phe Glu Asn Leu Thr Ala Gly Tyr
 35          40          45
Asn Lys Phe Leu Arg Pro Asn Phe Gly Gly Glu Pro Val Gln Ile Ala
 50          55          60
Leu Thr Leu Asp Ile Ala Ser Ile Ser Ser Ile Ser Glu Ser Asn Met
 65          70          75          80
Asp Tyr Thr Ala Thr Ile Tyr Leu Arg Gln Arg Trp Met Asp Gln Arg
 85          90          95
Leu Val Phe Glu Gly Asn Lys Ser Phe Thr Leu Asp Ala Arg Leu Val
100          105          110
Glu Phe Leu Trp Val Pro Asp Thr Tyr Ile Val Glu Ser Lys Lys Ser
115          120          125
Phe Leu His Glu Val Thr Val Gly Asn Arg Leu Ile Arg Leu Phe Ser
130          135          140
Asn Gly Thr Val Leu Tyr Ala Leu Arg Ile Thr Thr Thr Val Ala Cys
145          150          155          160
Asn Met Asp Leu Ser Lys Tyr Pro Met Asp Thr Gln Thr Cys Lys Leu
165          170          175
Gln Leu Glu Ser Trp Gly Tyr Asp Gly Asn Asp Val Glu Phe Thr Trp
180          185          190
Leu Arg Gly Asn Asp Ser Val Arg Gly Leu Glu His Leu Arg Leu Ala
195          200          205
Gln Tyr Thr Ile Glu Arg Tyr Phe Thr Leu Val Thr Arg Ser Gln Gln
210          215          220
Glu Thr Gly Asn Tyr Thr Arg Leu Val Leu Gln Phe Glu Leu Arg Arg
225          230          235          240
Asn Val Leu Tyr Phe Ile Leu Glu Thr Tyr Val Pro Ser Thr Phe Leu
245          250          255
Val Val Leu Ser Trp Val Ser Phe Trp Ile Ser Leu Asp Ser Val Pro
260          265          270
Ala Arg Thr Cys Ile Gly Val Thr Thr Val Leu Ser Met Thr Thr Leu
275          280          285
Met Ile Gly Ser Arg Thr Ser Leu Pro Asn Thr Asn Cys Phe Ile Lys
290          295          300
Ala Ile Asp Val Tyr Leu Gly Ile Cys Phe Ser Phe Val Phe Gly Ala
305          310          315          320
Leu Leu Glu Tyr Ala Val Ala His Tyr Ser Ser Leu Gln Gln Met Ala

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| | | | | | | | | | | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|--|
| | | | | 325 | | | | | 330 | | | | | 335 | | |
| Ala | Lys | Asp | Arg | Gly | Thr | Thr | Lys | Glu | Val | Glu | Glu | Val | Ser | Ile | Thr | |
| | | | | 340 | | | | | 345 | | | | | 350 | | |
| Asn | Ile | Ile | Asn | Ser | Ser | Ile | Ser | Ser | Phe | Lys | Arg | Lys | Ile | Ser | Phe | |
| | | | | 355 | | | | | 360 | | | | | 365 | | |
| Ala | Ser | Ile | Glu | Ile | Ser | Ser | Asp | Asn | Val | Asp | Tyr | Ser | Asp | Leu | Thr | |
| | | | | 370 | | | | | 375 | | | | 380 | | | |
| Met | Lys | Thr | Ser | Asp | Lys | Phe | Lys | Phe | Val | Phe | Arg | Glu | Lys | Met | Gly | |
| 385 | | | | | | 390 | | | | | 395 | | | | 400 | |
| Arg | Ile | Val | Asp | Tyr | Phe | Thr | Ile | Gln | Asn | Pro | Ser | Asn | Val | Asp | His | |
| | | | | 405 | | | | | | 410 | | | | | 415 | |
| Tyr | Ser | Lys | Leu | Leu | Phe | Pro | Leu | Ile | Phe | Met | Leu | Ala | Asn | Val | Phe | |
| | | | | 420 | | | | | 425 | | | | | 430 | | |
| Tyr | Trp | Ala | Tyr | Tyr | Met | Tyr | Phe | | | | | | | | | |
| | | | | 435 | | | | | 440 | | | | | | | |

```
<210> 40
<211> 289
<212> PRT
<213> Homo sapien
```

| | | | | | | | | | | | | | | | | |
|-----|----------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|--|
| | <400> 40 | | | | | | | | | | | | | | | |
| Met | Asn | Tyr | Ser | Leu | His | Leu | Ala | Phe | Val | Cys | Leu | Ser | Leu | Phe | Thr | |
| 1 | | | | 5 | | | | | 10 | | | | | 15 | | |
| Glu | Arg | Met | Cys | Ile | Gln | Gly | Ser | Gln | Phe | Asn | Val | Glu | Val | Gly | Arg | |
| | | | 20 | | | | | 25 | | | | | 30 | | | |
| Ser | Asp | Lys | Leu | Ser | Leu | Pro | Gly | Phe | Glu | Asn | Leu | Thr | Ala | Gly | Tyr | |
| | | 35 | | | | | 40 | | | | | 45 | | | | |
| Asn | Lys | Phe | Leu | Arg | Pro | Asn | Phe | Gly | Gly | Glu | Pro | Val | Gln | Ile | Ala | |
| | 50 | | | | | 55 | | | | | 60 | | | | | |
| Leu | Thr | Leu | Asp | Ile | Ala | Ser | Ile | Ser | Ser | Ile | Ser | Glu | Ser | Asn | Met | |
| 65 | | | | | 70 | | | | | 75 | | | | 80 | | |
| Asp | Tyr | Thr | Ala | Thr | Ile | Tyr | Leu | Arg | Gln | Arg | Trp | Met | Asp | Gln | Arg | |
| | | | | 85 | | | | | 90 | | | | | 95 | | |
| Leu | Val | Phe | Glu | Gly | Asn | Lys | Ser | Phe | Thr | Leu | Asp | Ala | Arg | Leu | Val | |
| | | | 100 | | | | | 105 | | | | | 110 | | | |
| Glu | Phe | Leu | Trp | Val | Pro | Asp | Thr | Tyr | Ile | Val | Glu | Ser | Lys | Lys | Ser | |
| | | | 115 | | | | 120 | | | | | 125 | | | | |
| Phe | Leu | His | Glu | Val | Thr | Val | Gly | Asn | Arg | Leu | Ile | Arg | Leu | Phe | Ser | |
| | 130 | | | | | 135 | | | | | 140 | | | | | |
| Asn | Gly | Thr | Val | Leu | Tyr | Ala | Leu | Arg | Ile | Thr | Thr | Thr | Val | Ala | Cys | |
| 145 | | | | 150 | | | | | | 155 | | | | 160 | | |
| Asn | Met | Asp | Leu | Ser | Lys | Tyr | Pro | Met | Asp | Thr | Gln | Thr | Cys | Lys | Leu | |
| | | | 165 | | | | | | 170 | | | | 175 | | | |
| Gln | Leu | Glu | Ser | Trp | Gly | Tyr | Asp | Gly | Asn | Asp | Val | Glu | Phe | Thr | Trp | |
| | | | 180 | | | | | 185 | | | | | 190 | | | |
| Leu | Arg | Gly | Asn | Asp | Ser | Val | Arg | Gly | Leu | Glu | His | Leu | Arg | Leu | Ala | |
| | | 195 | | | | 200 | | | | | | 205 | | | | |
| Gln | Tyr | Thr | Ile | Glu | Arg | Tyr | Phe | Thr | Leu | Val | Thr | Arg | Ser | Gln | Gln | |
| | 210 | | | | | 215 | | | | | 220 | | | | | |
| Glu | Thr | Gly | Asn | Tyr | Thr | Arg | Leu | Val | Leu | Gln | Phe | Glu | Leu | Arg | Arg | |
| 225 | | | | 230 | | | | | | 235 | | | | 240 | | |
| Asn | Val | Leu | Tyr | Phe | Ile | Leu | Glu | Thr | Tyr | Val | Pro | Ser | Thr | Phe | Leu | |
| | | | 245 | | | | | | 250 | | | | | 255 | | |
| Val | Val | Leu | Ser | Trp | Val | Ser | Phe | Trp | Ile | Ser | Leu | Asp | Ser | Val | Pro | |
| | | 260 | | | | | 265 | | | | | | 270 | | | |
| Ala | Arg | Thr | Arg | Ile | Gly | Asp | Asn | Lys | Gly | Ser | Arg | Arg | Ser | Gln | Tyr | |
| | 275 | | | | | 280 | | | | | | 285 | | | | |

Tyr

<210> 41
 <211> 265
 <212> PRT
 <213> Homo sapien

<400> 41
 Met Asn Tyr Ser Leu His Leu Ala Phe Val Cys Leu Ser Leu Phe Thr
 1 5 10 15
 Glu Arg Met Cys Ile Gln Gly Ser Gln Phe Asn Val Glu Val Gly Arg
 20 25 30
 Ser Asp Lys Leu Ser Leu Pro Gly Phe Glu Asn Leu Thr Ala Gly Tyr
 35 40 45
 Asn Lys Phe Leu Arg Pro Asn Phe Gly Gly Glu Pro Val Gln Ile Ala
 50 55 60
 Leu Thr Leu Asp Ile Ala Ser Ile Ser Ser Ile Ser Glu Ser Asn Met
 65 70 75 80
 Asp Tyr Thr Ala Thr Ile Tyr Leu Arg Gln Arg Trp Met Asp Gln Arg
 85 90 95
 Leu Val Phe Glu Gly Asn Lys Ser Phe Thr Leu Asp Ala Arg Leu Val
 100 105 110
 Glu Phe Leu Trp Val Pro Asp Thr Tyr Ile Val Glu Ser Lys Lys Ser
 115 120 125
 Phe Leu His Glu Val Thr Val Gly Asn Arg Leu Ile Arg Leu Phe Ser
 130 135 140
 Asn Gly Thr Val Leu Tyr Ala Leu Arg Ile Thr Thr Thr Val Ala Cys
 145 150 155 160
 Asn Met Asp Leu Ser Lys Tyr Pro Met Asp Thr Gln Thr Cys Lys Leu
 165 170 175
 Gln Leu Glu Ser Trp Gly Tyr Asp Gly Asn Asp Val Glu Phe Thr Trp
 180 185 190
 Leu Arg Gly Asn Asp Ser Val Arg Gly Leu Glu His Leu Arg Leu Ala
 195 200 205
 Gln Tyr Thr Ile Glu Arg Tyr Phe Thr Leu Val Thr Arg Ser Gln Gln
 210 215 220
 Glu Thr Gly Asn Tyr Thr Arg Leu Val Leu Gln Phe Glu Leu Arg Arg
 225 230 235 240
 Asn Val Leu Tyr Phe Ile Leu Asp Leu Ser Arg Phe Ser Pro Cys Lys
 245 250 255
 Asn Leu His Trp Gly Gln Gln Arg Lys
 260 265

<210> 42
 <211> 574
 <212> DNA
 <213> Homo sapien

<220>
 <221> misc_feature
 <222> (1)...(574)
 <223> n = A,T,C or G

<400> 42
 accaacanag cttagtaatt tctaaaaaga aaaaatgatc tttttccgac ttctaaacaa 60
 gtgactatac tagcataaat cattcttcta gtaaacagc taaggtatag acattctaatt 120
 aatttgggaa aacctatgat tacaagtaaa aactcagaaa tgcaaatgatg ttgggttttt 180

```

gtttctcagt ctgcttttagc ttttaactct ggaaacgcat gcacactgaa ctctgctcag      240
tgctaaacag tcaccagcag gttcctcagg gtttcagccc taaaatgtaa aacctggata      300
atcagtgtat gttgcaccag aatcagcatt ttttttttaa ctgcaaaaaa tgatgggtctc      360
atctctgaat ttatatttct cattcttttg aacatactat agctaataa ttttatgttg      420
ctaaattgct tctatctagc atgttaaaca aagataatat actttcgatg aaagtaaatt      480
ataggaaaaa aattaactgt tttaaaaaga acttgattat gttttatgat ttcaggcaag      540
tattcatttt taacttgcta cctactttta aata                                     574

```

```

<210> 43
<211> 467
<212> DNA
<213> Homo sapien

```

```

<220>
<221> misc_feature
<222> (1)...(467)
<223> n = A,T,C or G

```

```

<400> 43
tttttttttt ttttttattg ccatcaattt attaaaaataa acatgtatag caggtttcaa      60
caattgtctt gtagtttgta gtaaaaagac ataagaaaga gaagggtgtg tttgcagcaa      120
tccgtagctg gtttctcacc ataccctgca gttctgtgag ccaaaggctt tgcagaaagt      180
taaaataaat cacaaagact gctgtcatat attaattgca taaacacctc aacattgctc      240
anagtttcat ccgtttggtt aanaaaacat tctttcaatt catctatggc atttgtagtg      300
gcattgtcgt ctatgaactc ttgaagaagt tctttgtatt cagtcttaga cacttggtgga      360
ttgattgtct tggaaatcac attctccaat aaggggcagc cagagcctgc gtagcagtg      420
tgaggagagg ccgccagcat gaggaccatc agcaacttca tgggtgag                                     467

```

```

<210> 44
<211> 613
<212> DNA
<213> Homo sapien

```

```

<220>
<221> misc_feature
<222> (1)...(613)
<223> n = A,T,C or G

```

```

<400> 44
tttttttttt ttttttttag ttttaaaata ttttcacttt attattatgc ttataatatt      60
attccaacag actgtattaa aggcagtgat cactaacaca gaacacgaca gggcgaagag      120
gcagccgggc cgattgcagg acgtggcctg tcggggccagg gtcgctgaca tgcacgctgg      180
tagctcatic actgctaccc tcagcacagg ctgcaggaat agggacaaga cagatgccgc      240
cggactctta gaagctatth aataaatatc atccaaaaac aaaatggaaa agaaacaaga      300
aaccttccga gcacaaccac cttaggccaa ctgaatgtaa tctagtttat tcaacaaaaa      360
attgagagag aaggaaaata ttgaaacaaa caaacgaaag aaagcagttc ttaagactag      420
cagtaaataa atttatacaa cagttcggtc tgtataatat gatgaaataa atctacatct      480
tttcttattt tggngctttg aattatacat acaaacacaa attacaggga cttgtttcaca      540
aagcatgtag gcctanaaaa aggctctctg aaacctcaa tggcaactgg tgaacggtaa      600
cactgattgc cca                                     613

```

```

<210> 45
<211> 334
<212> DNA
<213> Homo sapien

```

```

<220>
<221> misc_feature

```

<222> (1) ... (334)

<223> n = A,T,C or G

<400> 45

| | | | | | | |
|-------------|------------|-------------|------------|------------|------------|-----|
| accagaccaa | gtgaatgcga | caggggaatta | tttcctgtgt | tgataattca | tgaagtagaa | 60 |
| cagtataatc | aaaatcaatt | gtatcatcat | tagttttcca | ctgcctcaca | ctagttagct | 120 |
| gtgccaaagta | gtagtgtgac | acctgtgttg | tcattttcca | catcacgtaa | gagcttccaa | 180 |
| ggaaagccaa | atcccagatg | agtctcagag | agggatcaat | atgtccatga | ttatcaggta | 240 |
| tgctgactat | ttccaagggg | tttttcagtt | gcttcatttg | cttgtaaagc | aggtaatcct | 300 |
| cttggtgtnt | tttctttttc | tcgatgagcc | gtgt | | | 334 |

<210> 46

<211> 429

<212> DNA

<213> Homo sapien

<220>

<221> misc_feature

<222> (1) ... (429)

<223> n = A,T,C or G

<400> 46

| | | | | | | |
|------------|------------|-------------|-------------|------------|-------------|-----|
| acaattttnt | taaacaagca | gaatagcact | aggcagaata | aaaaattgca | cagacgtatg | 60 |
| caattttcca | agatagcatt | ctttaaattc | agtattcagc | ttccaaagat | tggttgccca | 120 |
| taatagactt | aaacatataa | tgatggctaa | aaaaaataag | tatacgaaaa | tgtaaaaaag | 180 |
| gaaatgtaag | tccactctca | atctcataaa | aggtgagagt | aaggatgcta | aagcaaaaata | 240 |
| aatgtagggt | ctttttttct | atttcctgtt | atcatgcagt | ctgcttcttt | gatatgcctt | 300 |
| agggttaccc | atttaagtta | gagggttgtaa | tgcaatgggtg | ggaatgaaaa | ttgatcaaat | 360 |
| atacaccttg | tcatttcatt | tcaaattgcg | gntggaaact | tccaaaaaaa | gggtaggcat | 420 |
| gaagaaaaa | | | | | | 429 |

<210> 47

<211> 394

<212> DNA

<213> Homo sapien

<220>

<221> misc_feature

<222> (1) ... (394)

<223> n = A,T,C or G

<400> 47

| | | | | | | |
|-------------|-------------|------------|------------|------------|-------------|-----|
| acgcgaantt | gtgttatgac | tgatagcctt | cagctacaaa | angataggac | tgacctggtt | 60 |
| taaagtgttc | tattttgtaa | atcattccat | ttgagtcttt | ctgatgaact | tggtataact | 120 |
| gaaatctggt | atttttagtga | ggctccaaaa | tgagcaaagc | taggcctgat | tagagtagag | 180 |
| tgactattaa | aaaacataac | tttctaggag | ctataaatca | aagtttttaa | aagatgtttg | 240 |
| gatatatattg | agtattccga | tcatgaaaac | agaaattgcc | ctgcctacta | caaggacaga | 300 |
| ctgatgggaa | attatgcacc | tggtcaactt | agcttttaag | cagacgatgc | tgtaaaaaaca | 360 |
| aacggcttct | ctgatattta | ttgtaagttt | tagt | | | 394 |

<210> 48

<211> 486

<212> DNA

<213> Homo sapien

<400> 48

| | | | | | | |
|-------------|------------|------------|------------|------------|------------|-----|
| acaaagggaac | cgaggggtga | ccacctctga | gatgtccttg | actttgtcat | agcctggggc | 60 |
| atattgagca | tctctctcac | agctgccttt | cttatcccca | ttcttgatgt | agacctcctt | 120 |

```

ccgagtcagc tttttctcct cctcagacac aaacagagct ttgatatacct gtgcagggag      180
cagctcttcc ttttggtgct ggcaagtggg agttggagga agcctcaaag ctcgagttgt      240
tccctcggtg caggggagac aaatgggcct gatagtctgg ccatatttca gcttattctt      300
gagcttgatc agggcaacgt catagtcata aaattcagga attcctgctt cttttttccc      360
attaatgttg tagttggggg gaaataggac tacttctatc tccagggtccc gcttctcccc      420
tcccttgatt gagtggttcct tgtcatccac agtgaaacaa tgtgctgctg tcagcacaaa      480
gtacct                                           486

```

```

<210> 49
<211> 487
<212> DNA
<213> Homo sapien

```

```

<400> 49
acgggctgac agagaagatt cccgagagta aatcatcttt ccaatccaga ggaacaagca      60
tgtctctctg ccaagatcca tctaaactgg agtgatgtta gcagaccag cttagagttc      120
ttctttcttt cttaagccct ttgctctgga ggaagttctc cagcttcagc tcaactcaca      180
gcttctccaa gcatcacccct gggagtttcc tgagggtttt ctcataaatg agggctgcac      240
attgcctggt ctgcttcgaa gtattcaata ccgctcagta ttttaaatga agtgattcta      300
agatttggtt tgggatcaat aggaaagcat atgcagccaa ccaagatgca aatgttttga      360
aatgatatga ccaaaatttt aagtaggaaa gtcacccaaa cacttctgct ttcacttaag      420
tgtctggccc gcaatactgt aggaacaagc atgatcttgt tactgtgata ttttaaatat      480
ccacagt                                           487

```

```

<210> 50
<211> 460
<212> DNA
<213> Homo sapien

```

```

<220>
<221> misc_feature
<222> (1)...(460)
<223> n = A,T,C or G

```

```

<400> 50
acatattttg gttgaagaca ccagactgaa gtaaacagct gtgcatccaa tttattatag      60
ttttgtaagt aacaatatgt aatcaaaactt ctagggtgact tgagagtgga acctcctata      120
tcattattta gcaccgttta tgacagtaac catttcagtg tattgtttat tataccactt      180
atatcaactt atttttcacc aggttaaaat tttaatttct acaaaataac attctgaatc      240
aagcacactg tatgttcagt aggttgaact atgaacactg tcatcaatgt tcagttcaaa      300
agcctgaaag tttagatcta gaagctggta aaaatgacaa tatcaatcac attaggggaa      360
ccattgttgt cttcacttaa tccatttagc actattgaaa ataagcacac caagntatat      420
gactaatata acttgaaaat tttttatact gaggggggtn      460

```

```

<210> 51
<211> 529
<212> DNA
<213> Homo sapien

```

```

<400> 51
acacttgaaa ccaaatcttct aaaacttggt tttcttaaaa aatagttggt gtaacattaa      60
accataacct aatcagtggt ttcactatgc ttccacacta gccagtcttc tcacacttct      120
tctggtttca agtctcaagg cctgacagac agaagggcct ggagattttt tttctttaca      180
attcagttct cagcaacttg agagctttct tcatgttgct aagcaacaga gctgtatctg      240
caggttcgta agcatagaga cggtttgaat atcttccagt gatatcggct ctaactgtca      300
gagatgggtc aacaaacata atcctgggga catactggcc atcaggagaa aggtgtttgt      360
cagttgtttc ataaaccaga ttgaggagga caaactgctc tgccaatttc tggatttctt      420
tattttcagc aaacactttc tttaaagctt gactgtgtgg gcactcatcc aagtgatgaa      480

```

taaatcatca aggggtttgtt gcttgtcttg gatttatata gagcttctt 529

<210> 52
 <211> 379
 <212> DNA
 <213> Homo sapien

<400> 52
 actttgccaa gcagtaaagg atccaggaga tagcactgga tgtgggtgtca tgtcctgcaa 60
 acatgaacgt tttcacttca gcctggagat ctgcttcaga gaaatctttg gtgttttcgc 120
 ttttggcact caaaagtatg tccagaaaat cccagcgcct tttctgagta gtatcttgtt 180
 ttagcttata ctttaagagac tccttccggt cctggattac tttctctgtg aactgatgaa 240
 gttcttgggt aaatttagaa aagatttggc cttgagagct gaatttgaaa accaggctgt 300
 tgtgatgtag aaaattgttc atgcgctggt tggagatttt gctaagggtg aacactgctt 360
 tcaggatatga gtccaagggt 379

<210> 53
 <211> 380
 <212> DNA
 <213> Homo sapien

<220>
 <221> misc_feature
 <222> (1)...(380)
 <223> n = A,T,C or G

<400> 53
 acttttatct taaaagggtg gtagttttcc ctaaaatact tattatgtaa gggtcattag 60
 acaaatgtct tgaagtagac atggaattta tgaatgggtc tttatcattt ctcttcccc 120
 tttttggcat cctggcttgc ctccagtttt aggtccttta gtttgcttct gtaagcaacg 180
 ggaacacctg ctgagggggc tctttccctc atgtatactt caagtaagat caagaatctt 240
 ttgtgaaatt atagaaattn actatgtaaa tgcttgatgg aatnntttcc tgctagtgtg 300
 gcttctgaaa ggcgctttct ccatttatctt aaaactaccc atgcaattaa aaggtacctt 360
 gccgcgacca cnctaanggc 380

<210> 54
 <211> 245
 <212> DNA
 <213> Homo sapien

<400> 54
 gcgcggcgct tcactttctc aacttccggt ccggtctgcc cagcgcgctg cgagtgtgtg 60
 ccgaggtgca ggagggccgc gcgtggatta atccaaaaga gggatgtaaa gttcacgtgg 120
 tcttcagcac agagcgctac aacccagagt ctttacttca ggaagggtgag ggacgtttgg 180
 ggaaatgttc tgctcgagtg tttttcaaga atcagaaacc cagaccaacc atcaatgtaa 240
 cttgt 245

<210> 55
 <211> 556
 <212> DNA
 <213> Homo sapien

<400> 55
 acagaagatg aataataatg aaaaactgtg attttttgac tatcacatac attgtgttaa 60
 aaaacaggta aatataatga ctattactgt taagaaagac aaggaggaaa actgtttcaa 120
 tgttcagggt taaatactaa gcacaaaaat ataacaaatt ctgtgtctac aataattttt 180
 gaagtgtata caagtgcatt gcaaatgagc tctttaaaat ttaaagtcca tttcccttt 240
 agccaagcat atgtctacat ttatgatctt tttctcttat tttaaagtct cttctgtgtt 300

```

agtttttttaa aaagtttcat catggctgtc atcttggaat ctagcctcca gctcaaagct    360
gagacttcac gcatacatat tctcctttct gggtgcatct tcacctagtt tctccaagta    420
ttcagagtta aatagcaciaa cttcctttat atgttcactt ttgtccacat gtagtggcag    480
tgctgctgct tcagtaggct ttctcacaca cccttttctt tctttcaaca gcagtcacca    540
aacgttcaca acacaa                                     556

```

```

<210> 56
<211> 166
<212> DNA
<213> Homo sapien

<220>
<221> misc_feature
<222> (1) ... (166)
<223> n = A,T,C or G

```

```

<400> 56
atggggccctg attacatcat tatgaactac tcagggnnaac atcccaaata ccgacctngg    60
gaaagacttg gtccgagatg tgttcatcca tacaggctac ctcttccaga gcncaggnc    120
caagagctgc ntnatcacct acctggccca ggtggacccc anaggg                    166

```

```

<210> 57
<211> 475
<212> DNA
<213> Homo sapien

<220>
<221> misc_feature
<222> (1) ... (475)
<223> n = A,T,C or G

```

```

<400> 57
acatccnecat gttcctccaa atgacgtttg gggtcctgct tgccaacatt ctttattgcc    60
agctgttcag gtgtcatctt atcttcttct tctacagcct tattgtaatt cttggctaatt    120
tccaacatct cttttaccac tgattcattg cgtttacaat gttcactgta gtctgaagt    180
gtcaaaccctt ccatccaact cttcttatgc aaatttagca acatcttctg ttccagttca    240
tttttccgat agttaatagt aatggagtaa taatgtctgt ttagtccatg aattaatgcc    300
tggatagatg gcttggttaa gtgaccaga ttcgaagtgg tttgtcttgg ttcattgctct    360
aagaccatca tattagcatt gatcaatctg aaggcatcaa taacaacctt tctttttaca    420
ctctgaatgg gatccacaac cactgccaca gntctctccg ataaggcttc aaagc        475

```

```

<210> 58
<211> 520
<212> DNA
<213> Homo sapien

<220>
<221> misc_feature
<222> (1) ... (520)
<223> n = A,T,C or G

```

```

<400> 58
actgttnatg tgctacttgc atttgtccct cttcctgtgc actaaagacc ccactcactt    60
ccctagtgtt cagcagtgga tgacctctag tcaagacctt tgcactagga tagttaatgt    120
gaaccatggc aactgatcac aacaatgtct ttcagatcag atccatttta tctccttctg    180
tttacagcaa gggatattaa ttacctatgt tacctttccc tgggactatg aatgtgcaaa    240
attccaatgt tcatggcttc tccctttaa cctatatctt accccttcta cattatagaa    300
aggaatgctg gaaaccaga gtccttctct tgggactctt aatgtgtatt tctaattatc    360

```


| | | | | | | |
|-------------|------------|------------|------------|------------|-------------|-----|
| catgactctt | aatgtgcata | ttttcaattg | cctaattgat | ttcaattgtc | taagacattt | 420 |
| caaattgtcta | attggggaga | actgagtctt | ttatatcaag | ctaatatcta | gctttttatat | 480 |
| caagctaata | tcttgacttc | tcagcatcat | agaagggggt | | | 520 |

<210> 59
 <211> 214
 <212> DNA
 <213> Homo sapien

<220>
 <221> misc_feature
 <222> (1)...(214)
 <223> n = A,T,C or G

| | | | | | | |
|------------|------------|-------------|------------|------------|-------------|-----|
| ctggcaggaa | atgcatcaaa | agacttaaag | gtanagcgta | ttacccctcg | tcacttgcaa | 60 |
| cttgctattc | gtggagatga | agaattggat | tctctcatca | aggctacaat | tgctgggtggn | 120 |
| ggtgtcattc | cacacatcca | caaattctctg | atngggaana | aaggacaaca | naagactgnc | 180 |
| taanggatgc | ctgnatncct | tggaattctca | tgac | | | 214 |

<210> 60
 <211> 360
 <212> DNA
 <213> Homo sapien

<220>
 <221> misc_feature
 <222> (1)...(360)
 <223> n = A,T,C or G

| | | | | | | |
|------------|------------|------------|------------|------------|------------|-----|
| gcatacaaca | tggcagcagg | gcctcgggaa | gangggtagg | aggaccgagc | agcattctct | 60 |
| gtagaggaag | acaggaaaag | agaccctctt | ggcacacatt | tatggagggt | tgccctgaa | 120 |
| gagaagggca | ggtgggagag | gttccctgtt | acttaagaga | aggcaccagt | ggcaaagagc | 180 |
| acaatgaaga | ggatgatgat | aaaaacaatc | acgcagataa | ggacaatcat | cttcacgttc | 240 |
| ttccaccaga | attttcgagc | caccttctgc | gatgtcgtct | tgaagtgtct | agatgtggct | 300 |
| tccagatcct | ctgtcttggt | gcggagatgt | tcgaagtttt | ccccccgggc | caggatccgc | 360 |

<210> 61
 <211> 391
 <212> DNA
 <213> Homo sapien

<220>
 <221> misc_feature
 <222> (1)...(391)
 <223> n = A,T,C or G

| | | | | | | |
|------------|------------|------------|------------|------------|------------|-----|
| tntgggatcg | tactcgatta | aacagagcca | cctttgttcc | tgaggcaatg | cataantcan | 60 |
| catttttcaa | tgactgtctc | tttttggaag | gnttgagat | gacttttatc | cgcttgctga | 120 |
| ggaacacacc | aatgncatca | ctgttgccat | agaacatctt | tacagacaac | atgaantgct | 180 |
| ttcgcttgtc | tgagtcagat | atatacaatg | ttttggctgt | gcaatagtct | tttcttcca | 240 |
| agtttagctg | ctgcatttct | tggnactat | ttcctatccc | aataaatgca | cacgggtgag | 300 |
| actcttgntc | agaacaacca | tcnctgtcca | tttgttcttt | ttttntcttc | catccactgc | 360 |
| ccataagata | tacacannga | ggtgggcaaa | a | | | 391 |

<210> 62

<211> 324
 <212> DNA
 <213> Homo sapien

<220>
 <221> misc_feature
 <222> (1) ... (324)
 <223> n = A,T,C or G

<400> 62
 acaattttat tttaacagat ttcaagagtc catttttttaa aaaatgagca ataaagaacc 60
 tctatcagtg agacttctca ttttatagca aatacatttt tgcagcttaa attttcttga 120
 attcatatac gcttctgtca tttaaacaaa cttccagaga aaactgggtct ctatatattt 180
 aagtaacaaa ttgacaaaa tacatatatta tacatatata gancctctaata ataaatatta 240
 aatttgaaaa aatcaaatgt gaagcagaaa ctgctataca agtatattgt ntaatatcta 300
 tntnatacat taaagnnttc cggg 324

<210> 63
 <211> 360
 <212> DNA
 <213> Homo sapien

<220>
 <221> misc_feature
 <222> (1) ... (360)
 <223> n = A,T,C or G

<400> 63
 acagannccct tgaatatggt gtgggtccct cattatggcc cttcattccc ttctgtgtta 60
 atagtaaagc atgttgcccta ataactacaa ccctgaccaa atttgggcct ggatctcatg 120
 gggtcacgtgg agtttttaaat acgattttta atttacttgg gtaattgagc tgaatcttta 180
 gttttcagat tactttttta aacagatagg ctcttagaac aaattattaa aaacataata 240
 cccatttggg ggggaatctg gattaactac ccactgttcc ccccccccc aacttttgaa 300
 aaattttggc catatagaat gcatgaaaaa tcaggataga tcttatgagg actttatagt 360

<210> 64
 <211> 491
 <212> DNA
 <213> Homo sapien

<220>
 <221> misc_feature
 <222> (1) ... (491)
 <223> n = A,T,C or G

<400> 64
 nctgactgtg atgtccactt gttccctgat ttttacacat catgtcaaag ataacagctg 60
 tccccacca ccagttcttc taagcacata ctctgctttt ctgtcaacat cccatttttg 120
 ggaaaggaaa agtcatattt attcccgcac ccagttttt taacttggtc tcccagttgt 180
 cccctcttc tctgggtgta agaagggaaa ttggaaaaaa attatatata tattctcctt 240
 ttaatgggtg ggggctactg gagaggagag acagcaagtc caccctaact tggtacacag 300
 cacataccac aggttctgga attctcatct tcgaacctag agaaatagggt gctataaaca 360
 gggaattaag caaaatgctg gatgctatag atcttttaat tgncttaatt tttttctat 420
 tattaacta caggctgtag atntcttagg tctcacagaa cttntatcat tttaaactga 480
 cttgtatatt t 491

<210> 65
 <211> 484

<212> DNA

<213> Homo sapien

<220>

<221> misc_feature

<222> (1) ... (484)

<223> n = A,T,C or G

<400> 65

| | | | | | | |
|-------------|-------------|------------|------------|-------------|------------|-----|
| accagcacac | cggcgcgctc | ctggactgcg | ccttctacga | tccaacgcat | gcctggagtg | 60 |
| gaggactaga | tcatacaattg | aaaatgcatg | atttgaacac | tgatcaagaa | aatcttggtg | 120 |
| ggacccatga | tgcccctatc | agatgtgttg | aatactgtcc | agaagtgaat | gtgatggtca | 180 |
| ctggaagtgtg | ggatcagaca | gctaaactgt | gggatcccg | aactccttgt | aatgctggga | 240 |
| ccttctctca | gcctgaaaag | gtatataccc | tctcagtgtc | tggagaccgg | ctgattgtgg | 300 |
| gaacagcagg | ccgcagagng | ttggtgtggg | acttacggaa | catgggttac | gtgcagcagc | 360 |
| gcagggagtc | cagcctgaaa | taccagactc | gctgcatacg | agcgtttcca | aacaagcagg | 420 |
| gttatgtatt | aagctctatt | gaaggccgag | tggcagttga | gtattttggac | ccaagccctg | 480 |
| aggt | | | | | | 484 |

<210> 66

<211> 355

<212> DNA

<213> Homo sapien

<220>

<221> misc_feature

<222> (1) ... (355)

<223> n = A,T,C or G

<400> 66

| | | | | | | |
|------------|------------|------------|------------|------------|------------|-----|
| ngaagaaagt | atgggtggag | gtgaaggtaa | tcacagagct | gctgattctc | aaaacagtgg | 60 |
| tgaaggaaat | acaggtgctg | cagaatcttc | tttttctcag | gaggtttcta | gagaacaaca | 120 |
| gccatcatca | gcattctgaa | gacaggcccc | tcgagcacct | cagtcaccga | gacgccacc | 180 |
| acatccactt | cccccaagac | tgaccattca | tgccccacct | caggagtttg | gaccaccagt | 240 |
| tcagagaatt | cagatgaccc | gaaggcagtc | tgtaggacgt | ggccttcagt | tgactccagg | 300 |
| aataggtygc | acgcaacagc | atttttttga | tgatgaagac | agaacagttc | caagt | 355 |

<210> 67

<211> 417

<212> DNA

<213> Homo sapien

<400> 67

| | | | | | | |
|------------|------------|------------|------------|-------------|------------|-----|
| acgacacccc | tcaagaggtg | gccgaagctt | tcctgtcttc | cctgacagag | accatagaag | 60 |
| gagtcgatgc | tgaggatggg | cacagcccag | gggaacaaca | gaagcggaag | atcgtcctgg | 120 |
| acccttcagg | ctccatgaac | atctacctgg | tgctagatgg | atcagacagc | attggggcca | 180 |
| gcaacttcac | aggagccaaa | aagtgtctag | tcaacttaat | tgagaagggtg | gcaagttatg | 240 |
| gtgtgaagtc | aagatatggt | ctagtacat | atgccacata | ccccaaaatt | tggttcaaag | 300 |
| tgtctgaagc | agacagcagt | aatgcagact | gggtcacgaa | gcagctcaat | gaaatcaatt | 360 |
| atgaagacca | caagttgaag | tcagggacta | acaccaagaa | ggcctccag | gcagtgt | 417 |

<210> 68

<211> 223

<212> DNA

<213> Homo sapien

<220>

<221> misc_feature

<222> (1)...(223)

<223> n = A,T,C or G

<400> 68

| | | | | | | |
|------------|------------|-------------|------------|------------|------------|-----|
| cacttgcaag | cttgcttaca | gagacctgnt | aaacaaagaa | cagacagatt | ctataaaatc | 60 |
| agttatatca | acatataaag | gagtggtgatt | ttcagtttgt | ttttttaagt | aaatatgacc | 120 |
| aaactgacta | aataagaagg | caaaacaaaa | aattatgctt | ccttgacaag | gcctttggag | 180 |
| taaacaaaat | gctttaaggc | tcttggtgaa | tggggttgca | agg | | 223 |

<210> 69

<211> 396

<212> DNA

<213> Homo sapien

<400> 69

| | | | | | | |
|------------|------------|-------------|------------|------------|------------|-----|
| accttttttc | tctccaaagg | aacagtttct | aaagttttct | ggggggaaaa | aaaacttaca | 60 |
| tcaaatttaa | accatatggt | aaactgcata | ttagttgtgt | tacaccaaaa | aattgcctca | 120 |
| gctgatctac | acaagtttca | aagtcattaa | tgcttgatat | aaatttactc | aacattaaat | 180 |
| tatctttaat | tattaattaa | aaaaaaaaact | ttctaaggaa | aaataaacia | atgtagaccg | 240 |
| tgattatcaa | aggattatta | agaatcttt | acaaaaaatt | tcaaccctac | aacctaaaac | 300 |
| cgcaaatttc | tattttttaa | catcagaaaa | taactcttgg | ttcattactt | atgacccaaa | 360 |
| gtttttattt | cactattcaa | tatctgaaaa | gtatca | | | 396 |

<210> 70

<211> 402

<212> DNA

<213> Homo sapien

<220>

<221> misc_feature

<222> (1)...(402)

<223> n = A,T,C or G

<400> 70

| | | | | | | |
|------------|------------|------------|------------|-------------|------------|-----|
| accannccc | accaggcaa | acagctccga | catgtttngt | aagtgaagaca | agccagtgc | 60 |
| agtttttttt | tttttttct | ttttcttttt | tttgtctttt | gcttaccttc | ttgcttaatg | 120 |
| gaattgttat | ggctaagcac | atagaaggcc | aaaaaaggag | tttttcaaac | ccagcaaadc | 180 |
| aagtgccttg | attctgaact | gccaaaagaa | aactgcactt | cccctcttaa | gtaaaacgaa | 240 |
| atgagtttct | taggtaaatg | tattcatcag | cccagataaa | aaaaaaacca | gttatgtgag | 300 |
| cgttagtcac | tgctcatttc | caggaanac | aaacaaaata | ccagcccagc | cagactcaca | 360 |
| tgtgggnata | tatatataaa | gcaagagagc | cacaccacac | ag | | 402 |

<210> 71

<211> 385

<212> DNA

<213> Homo sapien

<220>

<221> misc_feature

<222> (1)...(385)

<223> n = A,T,C or G

<400> 71

| | | | | | | |
|------------|------------|------------|------------|------------|------------|-----|
| accagtagag | agtggcccct | gcaggccact | tataaacagg | aagctctctc | ctgagctcac | 60 |
| tgatcaacct | gcccttgga | cagacagaa | ctaccagaaa | agaacaagta | caaaacacta | 120 |
| tcattatctg | ttttctcaag | acagtcceaa | atgtccttgt | gcgatcgcca | caaactcagt | 180 |
| gattggccca | agtcattccc | gggtgccata | aacagtaact | ggtgtgcanc | attagaacaa | 240 |
| ggggacacgg | ccttgattct | cttctgagca | acatgaactg | ggatttctgc | cnccccggat | 300 |

ctcggtgcc acctccgaag aagtcgtgac cagccacctc cacagtaaaa gattcctccc 360
gtgagtatga tttggaatgc gncct 385

<210> 72
<211> 538
<212> DNA
<213> Homo sapien

<220>
<221> misc_feature
<222> (1)...(538)
<223> n = A,T,C or G

<400> 72
caattaatta acagaggtat aattgtctca ctttcagaag tgatcattta tttttattta 60
gcacaggtca taagaaaaat atatagaaaa ataatacaatt tcatatataa aaggattatt 120
tctccacctt taattattgg cctatcattt gttagtgtta tttggtcata ttattgaact 180
aatgtattat tccattcaaa gtctttctag atttaaaaat gtatgcaaaa gcttaggatt 240
atatcatgtg taactattat agataacatc ctaaaccctc agtttagata tataattgac 300
tggtgtgaat ctcttttcta atctgntttg acagatttct taaattatgt tagcataatc 360
aaggaagatt taccttgaag cactttccaa attgatactt tcaaacttat tttaaagcag 420
tagaaccttt tctatgaact aagtcacatg caaaactcca acctgtaagt atacataaaa 480
tggacttact tattcctctc accttctcca ggccctaggaa tattcttctc tggagccc 538

<210> 73
<211> 405
<212> DNA
<213> Homo sapien

<220>
<221> misc_feature
<222> (1)...(405)
<223> n = A,T,C or G

<400> 73
actttatnna tggaaatttc ttctacttgt atccatttnc cggggcttat ggacccttc 60
atactctcca tatttagaat caaaggttcc tttctgaaga gaccttaatt ttaaggtaaa 120
acgtggtcca agttcctgaa ttcccacttt cttttcactc ctgaatatgt atctgtgaaa 180
tctgaagaat atgtaatccc gttgattgtg gaatgtggca acctgccttc cgataaattg 240
aggattatga ggaaagagag atgcaaacat acgtccaatt gaatgaccca gccgtgttgt 300
aaaattattc agaattattt caggatgtgt ttctgtgggg tccttgccctc ttctcttaat 360
ttctttacga agacgaacac tgctcatttt aaaatgagca gttgg 405

<210> 74
<211> 498
<212> DNA
<213> Homo sapien

<220>
<221> misc_feature
<222> (1)...(498)
<223> n = A,T,C or G

<400> 74
tgagccctgc acctgtttcc tgcacccctt gccnactggt tctatggcca caaggagttt 60
taccagtaa aggagtttga ggtgtattat aagctgatgg aaaaataccc atgtgctgtt 120
cccttgtggg ttggaccctt tacgatgttc ttcagtgtcc atgaccaga ctatgccaaag 180
attctcctga aaagacaaga tcccaaaagt gctgttagcc acaaaatcct tgaatcctgg 240

```

gttggtcgag gacttgtgac cctggatggt tctaaatgga aaaagcacgc ccagattgtg      300
aaacctggct tcaacatcag cattctgaaa atattcatca ccatgatgtc tgagagtgtt      360
cggatgatgc tgaacaaatg ggaggaacac attgcccaaa actcacgtct ggagctcttt      420
caacatgtct cctgatgac cctggacagc atcatgaagt gtgccttcag ccaccagggc      480
agcatccagt tggacagt

```

```

<210> 75
<211> 458
<212> DNA
<213> Homo sapien

```

```

<400> 75
agccttgcac atgatactca gattcctcac ccttgcttag gagtaaaaca atatacttta      60
cagggtgata ataatctcca tagttatttg aagtggcttg aaaaaggcaa gattgacttt      120
tatgacattg gataaaatct acaaatcagc cctcgagtta ttcaatgata actgacaaac      180
taaattattt cctagaaaag gaagatgaaa ggagtggagt gtggtttggc agaacaactg      240
catttcacag cttttccagt taaattggag cactgaacgt tcagatgcat accaaattat      300
gcatgggtcc taatcacaca tataaggctg gctaccagct ttgacacagc actgtttcatc      360
tggtccaaaca actgtgtgta aaaacacatg taaaatgctt tttaacagct gatactgtat      420
aagacaaaagc caagatgcaa aattaggctt tgattggc

```

```

<210> 76
<211> 340
<212> DNA
<213> Homo sapien

```

```

<220>
<221> misc_feature
<222> (1) ... (340)
<223> n = A,T,C or G

```

```

<400> 76
accttatacc aaaanaatgc ttattccaaa atattttttg tagctagtag ttctttcctt      60
ggaggtaaag aaaatacacc caaactttta attaccagga ttcagaatat ttaagagaac      120
aatttttagtt aagaatcaaa tatactgaga ttcaaagagg ggaaaaaaaag gaaatattat      180
agaagacaaa ggtcaaatg gcattccaga tctggagcaa ttttgtaaag caggaaaaca      240
actatgacaa tctgnagctt cttagatcat tatagtgaat gtncccatth actataaggg      300
tttttataat ggtgtttcct aaataaagga acataaatgt

```

```

<210> 77
<211> 405
<212> DNA
<213> Homo sapien

```

```

<400> 77
actccatttg tggaaactcg gtccggagtct ggtaaacagc cgaatgtctt cctcccctac      60
agtttcctct ccttgcata gagcagtgat gtccctgatta aaggcattaa ttttatctat      120
caggaagaac attttttcat tttcgtcttc cggatgtcgc acaccatact tttgtagctc      180
ctctgttatt ctctggtgag tctccttgat ttgattttct aacaggggca gagattttaca      240
gatatgtgtg atgagctcgc tggtaagttt ttctgccagg cagggaaccg tggcctttcc      300
ttcctccagc agatccctga aatatgggtg gttctcaaa aagatcttct ctctctgcag      360
ggcttcggac aggtcagct ggtcctggat ctctgctgg ccccg

```

```

<210> 78
<211> 410
<212> DNA
<213> Homo sapien

```

<220>
 <221> misc_feature
 <222> (1)...(410)
 <223> n = A,T,C or G

<400> 78
 acagcagntn tagatggctg caacaacctt cctcctaccc cagcccagaa aatatttctg 60
 cccacccca ggatccggga ccaaaataaa gagcaagcag gcccccttca ctgaggtgct 120
 gggtagggct cagtgccaca ttactgtgct ttgagaaaaga ggaaggggat ttgtttggca 180
 ctttaaaaat agaggagtaa gcaggactgg agaggccaga gaagatacca aaattggcag 240
 ggagagacca tttggcgcca gtcccctagg agatgggagg agggagatag gtatgaggggt 300
 aggcgctaag aagagtagga ggggtccact ccaagtggca ggggtgctgaa atgggctagg 360
 accaacagga cactgactct aggtttatga cctgtccata cccgttccac 410

<210> 79
 <211> 512
 <212> DNA
 <213> Homo sapien

<220>
 <221> misc_feature
 <222> (1)...(512)
 <223> n = A,T,C or G

<400> 79
 acagtgaaaa acaactaat ataaagcatt ccagnngata aaaacctcct caggcttatg 60
 gtttgtttcc caaggaaatt atgtttcaat gtaaagtgtg aaatactcca gacatacatt 120
 ccatgtaggt tttgggtgcc aatgttaaaa tttcaaattt tgcattgcaag gcttagcaaa 180
 gaaacactgg cagaattcca gcatttgcaa aattctaagt tttgggtgaat attgtaaata 240
 ttacaattgg tattagaaaag ccatgatgaa tccagaatta agagaaaacc catttcataa 300
 atattttgtt tgattaaaaa ataccaggct taccatgttc taaataacac aagaaaatat 360
 ctttaaaaaa aaaaggactg caatttaaca gtaatctgta tatcttttagc tgccattaaa 420
 aaaagaaaaa agaacaacca aaaacaatga aaatgttaca actggtataa agtnaccna 480
 tgatgtctcc cttacgagaa aacaaaactg tc 512

<210> 80
 <211> 174
 <212> DNA
 <213> Homo sapien

<220>
 <221> misc_feature
 <222> (1)...(174)
 <223> n = A,T,C or G

<400> 80
 tgattcccca gacctcaaat gggctaacac gcttctcttc tncagcagnc ttctgtccg 60
 tgaagntncc ttccagattg gtacatggaa ctgaaaacaa agggagcctc agctggattg 120
 aaatctggag catgccacaa agncttgac tnggcatttt cnagaagaac ccat 174

<210> 81
 <211> 274
 <212> DNA
 <213> Homo sapien

<220>
 <221> misc_feature
 <222> (1)...(274)

<223> n = A,T,C or G

<400> 81

| | | | | | | |
|-------------|------------|------------|------------|------------|------------|-----|
| ttgcaacaag | cacattaaat | taaggcctgc | tngaatttct | tcctccccaa | tcaggtaaac | 60 |
| tttctttgcc | aataaagttt | gaggaggtgg | catttgaaaa | tctctttaaa | aaagaagtct | 120 |
| tcattctattc | acnagaaaac | tcaaaaataa | ttttcattat | caacacacaa | actaactcaa | 180 |
| tctctgcttt | aagtttctat | tggccaattt | ttctgattna | tacgagaatt | attntcagnt | 240 |
| ntagaaaatc | ctggtctttg | gtcattacaa | gntg | | | 274 |

<210> 82

<211> 101

<212> DNA

<213> Homo sapien

<220>

<221> misc_feature

<222> (1) ... (101)

<223> n = A,T,C or G

<400> 82

| | | | | | | |
|------------|-------------|------------|------------|------------|------------|-----|
| atggagaaga | tcgaacctga | gcctnntgag | aattgcctgc | tacngcctgg | cagccctgcc | 60 |
| cgagtggccc | agcnnccattt | cacnagntgg | gcatgatttg | n | | 101 |

<210> 83

<211> 182

<212> DNA

<213> Homo sapien

<400> 83

| | | | | | | |
|------------|------------|------------|------------|------------|-------------|-----|
| tattatgggg | aaagataact | gagaataaag | ctatcatgca | gatatttgca | gagataaaag | 60 |
| taatgcagat | actgagtgga | gttttgatca | aactatgctt | gaaagccact | ctaccactag | 120 |
| ttacacaaac | caataatttc | ccttcgcagt | ggaagtcage | ttgagttttt | tcagggtgttt | 180 |
| tt | | | | | | 182 |

<210> 84

<211> 229

<212> DNA

<213> Homo sapien

<220>

<221> misc_feature

<222> (1) ... (229)

<223> n = A,T,C or G

<400> 84

| | | | | | | |
|-------------|------------|------------|------------|------------|------------|-----|
| actgtttgta | gctgcactac | aacagattct | taccgtctcc | acaaaggcca | gagattgtaa | 60 |
| atgggtcaata | ctgacttttt | ttttattccc | ttgactcaag | acagctaact | tcattttcag | 120 |
| aactgtttta | aacctttgtg | tgctggttta | taaaataatg | tgngtaatcc | ttgttgcttt | 180 |
| cctgatacca | nactgtttcc | cgnggttggt | tagaatatat | tnngttcng | | 229 |

<210> 85

<211> 500

<212> DNA

<213> Homo sapien

<220>

<221> misc_feature

<222> (1) ... (500)

<223> n = A,T,C or G

<400> 85

| | | | | | | |
|------------|------------|-------------|------------|------------|------------|-----|
| ggggagtang | tgatttatta | aagcaagacg | ttgaaacctt | tacnttctgc | agtgaagatc | 60 |
| aggggtgcat | tgaaagacag | tggaaaccag | gatgaaagtt | tttacctgtc | acacactaca | 120 |
| tttcttcaat | attttcacca | ggacttccgc | aatgaggcct | cgtttctgaa | gggacatctg | 180 |
| atccgagcat | ctcttctact | ctaacttggc | tgcaacagct | tccagagggg | catcaaattt | 240 |
| ggcaagactt | aacttgaaca | gaggttctact | aatgaagaag | aagtctaaca | gctcagaaac | 300 |
| aagagctggg | cagaactcgg | cattggcctg | gtagcagcag | agggccagcg | tgaccagcag | 360 |
| gagacacacc | gacagcttca | tgggtggcttg | ttttgctgtg | agctcagctt | tcacaaacaa | 420 |
| tgagtgattt | ggactccacc | ccaggagcct | gtggagctgc | agagcccagg | gctatttgta | 480 |
| cctgcccggg | cggncgctcg | | | | | 500 |

<210> 86

<211> 323

<212> DNA

<213> Homo sapien

<220>

<221> misc_feature

<222> (1)...(323)

<223> n = A,T,C or G

<400> 86

| | | | | | | |
|------------|------------|-------------|------------|------------|------------|-----|
| ccgccagtgt | gctggaattc | gcccttgccg | cccgggcagg | tactcagaag | tcatttgta | 60 |
| tttacaattg | ggtttgtgtg | ggatgggatn | tanggcggat | gagccagtgc | ttttgcaatg | 120 |
| aagatgcaat | antcattgtc | ctctccctact | gtctcctctt | tcctcaccct | atggcagctn | 180 |
| tcattgacca | ttcccaaagg | gtccaccgag | tcttgaactc | agcttcatca | ccaacattcc | 240 |
| tcgccttcag | ttgaattcaa | cactgncaan | ggagnagang | caaagacttg | ggtcagggag | 300 |
| agggngggaa | acacanaaca | aac | | | | 323 |

<210> 87

<211> 230

<212> DNA

<213> Homo sapien

<400> 87

| | | | | | | |
|------------|------------|------------|------------|------------|------------|-----|
| gcagcattga | gccacccctt | tggcaggcga | tacggcagct | ctgtgccctt | ggccagcatg | 60 |
| tggagtggag | gagatgctgc | ccctgtggtt | ggaacatcct | ggggtgacct | ccgaccagc | 120 |
| ctcgtggggc | tgccccctgt | ccctatctct | cactctggac | ccagggctga | catcctaata | 180 |
| aaataactgt | tggattagac | aaaaaaaaaa | aaaaaaaaaa | aaaaaaaaag | | 230 |

<210> 88

<211> 249

<212> DNA

<213> Homo sapien

<220>

<221> misc_feature

<222> (1)...(249)

<223> n = A,T,C or G

<400> 88

| | | | | | | |
|------------|------------|------------|------------|------------|------------|-----|
| atgtgaccag | gtctaggtct | ggagtttcag | nttggacact | gagccaagca | gacaagcaaa | 60 |
| gcaagccagg | acacaccatc | ctgccccagg | cccagcttct | ctcctgcctt | ccaacgccat | 120 |
| ggggagcaat | ctcagcccc | aactctgcct | gatgcccttt | atcttggggc | tcttgtctgg | 180 |
| aggtgtgacc | accactccnt | ggtctttggc | ccggccccat | ggatcctgct | ctctggaggg | 240 |
| ggtntagat | | | | | | 249 |

<210> 89
 <211> 203
 <212> DNA
 <213> Homo sapien

<220>
 <221> misc_feature
 <222> (1) ... (203)
 <223> n = A,T,C or G

<400> 89
 tgtttacact gtcaaggatg acaaggaaag tgttcntatc tntgatacca tcatcccagc 60
 tgttcctcct cccactgacc tgcgattcac caacattggc ccagacacca tgcgtgtcac 120
 ctgggctcca ccccatcta ttgatttaac taacttcctg gtgcggnact cacctgtgaa 180
 aaatgangaa gatgttgag agt 203

<210> 90
 <211> 455
 <212> DNA
 <213> Homo sapien

<400> 90
 ctctaagggg gctggcaaca tggctcagca ggcttgcccc agagccatgg caaagaatgg 60
 acttgtaatt tgcacctcctg tgatcacctt actcctggac cagaccacca gccacacatc 120
 cagattaaaa gccaggaagc acagcaaacy tgcagtgaga gacaaggatg gagatctgaa 180
 gactcaaatt gaaaagctct ggacagaagt caatgccttg aaggaaattc aagccctgca 240
 gacagtctgt ctccgaggca ctaaagttca caagaaatgc taccttgctt cagaaggttt 300
 gaagcatttc catgaggcca atgaagactg catttccaaa ggaggaatcc tggttatccc 360
 caggaactcc gacgaaatca acgccctcca agactatggc aaaaggagcc tgccagggtg 420
 caatgacttt tggctgggca tcaatgacat ggtca 455

<210> 91
 <211> 488
 <212> DNA
 <213> Homo sapien

<400> 91
 actttgcttg ctcatatgca ttagtgcact ttataagtca ttgtatgtta ttatattccg 60
 taggtagatg tgtaacctct tcaccttatt catggctgaa gtcacctctt gggttacagta 120
 gcgtagcgtg gccgtgtgca tgctcctttgc gcctgtgacc accaccccaa caaacatcc 180
 agtgacaaac catccagtgg aggtttgtcg ggcaccagcc agcgtagcag ggtcgggaaa 240
 ggccacctgt cccactccta cgatacgcta ctataaagag aagacgaaat agtgacataa 300
 tatattctat ttttatactc ttctattttt ttagtgacc tgtttatgag atgctggttt 360
 tctacccaac ggccctgcag ccagctcacg tccaggttca acccacagct acttggtttg 420
 tgttcttctt catattctaa aaccattcca tttccaagca ctttcagtcc aataggtgta 480
 ggaaatag 488

<210> 92
 <211> 420
 <212> DNA
 <213> Homo sapien

<220>
 <221> misc_feature
 <222> (1) ... (420)
 <223> n = A,T,C or G

```

<400> 92
tctccggcag gctctgcccc ggctgtagcn agnnaaccta taatectgac cttttttgta      60
gacaaccttg gtgctgaggt taactccatc cattgtagtg gcctgtatat caatgggacg      120
attgcatatt tttcctgggt gagctttcca gaggtctgaa attttctccc cacctttagt      180
ctgagatact ttatcatgat cganccactc cgtccactcc acgtnttgaa cccactcact      240
ggacaaagaa acattgaaat attcgccatg ctctgtctgg aacaatttga ataccggggc      300
agcagcagag cctcgatgnc caggatattc aatatggctc tccactgaag atgatggatt      360
tcctttcaca gntagaaaac ttncnagggn gtctaaatcc aagggtgcagg aagngngngc      420

```

```

<210> 93
<211> 241
<212> DNA
<213> Homo sapien

```

```

<220>
<221> misc_feature
<222> (1) ... (241)
<223> n = A,T,C or G

```

```

<400> 93
accacgaatt ncaacatcca gatccaccac tatcctaatt ggattgtaac tngnaactgt      60
gcccggctcc tgaaagccga ccaccatgca accaacgggg tgggtgcacct catcgataag      120
gtcatctcca ccatcaccaa caacatccag cagatcattg agatcganga cacctttgag      180
acccttcggg ctgctgnggc tgcacacagg ctcaacacga tgcttgaagg naacggncag      240
t                                                                241

```

```

<210> 94
<211> 395
<212> DNA
<213> Homo sapien

```

```

<220>
<221> misc_feature
<222> (1) ... (395)
<223> n = A,T,C or G

```

```

<400> 94
actctattnt aattctgcct ttttatactt aattctaaat ttttcccctc taatttacia      60
caaattttgt gattttttata agaattctatg cctcccctaat tctcagattc ttctcttttc      120
tcctttattt ctttgcttaa attcagtata agctttcttg gtatttttagg cttcatgcac      180
attcttattc ctaaacacca gcagttcttc agagacctaa aatccagtat aggaataact      240
gtgttagttc ttgaaaaagc attaaagaca tttttccctg aaacatacag aacatgtcat      300
gccaaatctc ttgtttacat aataaactgg taataccggt gaattgcaca tacagatttt      360
atctccaaga tagaataact taaatattaa aacgt                                                                395

```

```

<210> 95
<211> 304
<212> DNA
<213> Homo sapien

```

```

<220>
<221> misc_feature
<222> (1) ... (304)
<223> n = A,T,C or G

```

```

<400> 95
cgaggtagac tgatngctcc ccctgggcaa tacaatacaa gaacngnggg ttttgtcaaa      60
ttggaacaag gaaacagaac cacagaaata aatacattgg ttaacatcag attagttcag      120

```

```

gttacttttt tgtaaaagtt aaagtacgag gggacttctg tattatgcta actcaagtan      180
actggaatct cctgttttct tttttttttt taaatnggtt ttaatttttt ttaattggat      240
ctatcttctt ccttaacatt tcagttggag tatgtagcat ttagcaccac tggctnaaac      300
ctgt                                           304

```

```

<210> 96
<211> 506
<212> DNA
<213> Homo sapien

```

```

<400> 96
acactgtcag cagggactgt aaacacagac aggggtcaaag tgttttctct gaacacattg      60
agttggaatc actgttttaga acacacacac ttactttttc tgggtctctac cactgctgat      120
atthttctcta ggaaatatac ttttacaagt aacaaaaata aaaactctta taaattttcta      180
tttttatctg agttacagaa atgattactg aggaagatta ctcagtaatt tgtttaaaaa      240
gtaataaaat tcaacaaaca tttgctgaat agctactata tgtcaagtgc tgtgcaagggt      300
attacactct gtaattgaat attattcctc aaaaaattgc acatagtaga acgctatctg      360
ggaagctatt tttttcagtt ttgatatttc tagcttatct acttccaaac taatttttat      420
ttttgctgag actaatctta atcattttct ctaatatggc aaccattata accttaattt      480
attattaacc atacccaaag aagtag                                           506

```

```

<210> 97
<211> 241
<212> DNA
<213> Homo sapien

```

```

<220>
<221> misc_feature
<222> (1) ... (241)
<223> n = A,T,C or G

```

```

<400> 97
atthttcttt taattacttt agagagctag ggatgcaaat gttttcagtt agaaagcctt      60
tatttacttt tggaaattga acaagaaatg catctgtctt agaaactgga gattatttga      120
tgtaggtaa aacatgtaat tgnntctctg gcaaatttgt atcantnatt ngaaaatgag      180
atattangaa aaaccaattc ttcttaaadc tagnncatct ttctttanaa gaacattana      240
t                                           241

```

```

<210> 98
<211> 79
<212> DNA
<213> Homo sapien

```

```

<220>
<221> misc_feature
<222> (1) ... (79)
<223> n = A,T,C or G

```

```

<400> 98
ggcaaacana cttatgctgn ancnggggtt tancaagggt ttcaaagnaa aaanccatt      60
ngactttatg gaaaatatt                                           79

```

```

<210> 99
<211> 316
<212> DNA
<213> Homo sapien

```

```

<220>

```

<221> misc_feature
 <222> (1)...(316)
 <223> n = A,T,C or G

<400> 99
 ccacatatgt aaaaccacaga aagaccngnt tngcactttc actgagagtt gagtcactctg 60
 ggctgtcnac aggtgtctga cgtgtaaact tggaatcaaa ctgacttaca tctctttcag 120
 attgcaacag aggttttaaag gggggctcca cctttcgagc cagaagttct tcccagttaa 180
 tgtgtctaaa gaatggatga gcttgaactt ctccagcgtc cccaggacca gctcccagac 240
 gagaagcagc atttcttttc agcagctttt taagcagatc tctggccttct tngtgtgaggt 300
 agggaggcaa attgag 316

<210> 100
 <211> 425
 <212> DNA
 <213> Homo sapien

<220>
 <221> misc_feature
 <222> (1)...(425)
 <223> n = A,T,C or G

<400> 100
 accgctttca gaaagtttat atgggttatt cttcagcctc tcttttatgc ctttcgacct 60
 ctgtttatca accccaaacc aattacgtat ctggaagta tcaataccgt ggcacaggtc 120
 acttttgaca ttttaattta ttactttttg ggaattaaat ccttagtcta catgttggca 180
 gcatctttac ttggcctggg tttgcaccca atttctggac attttatagc tgagcattac 240
 atgttcttaa agggncatga aacttactca tattatgggc ctctgaattt acttaccttc 300
 aatgtgggtt atcataatga acatcatgat ttccccaaca ttcttgaaa aagtcttcca 360
 ctggtgagga aaatagcagc tgaatactat gacaacctgc ctactacaa tttctggata 420
 aaagg 425

<210> 101
 <211> 156
 <212> DNA
 <213> Homo sapien

<220>
 <221> misc_feature
 <222> (1)...(156)
 <223> n = A,T,C or G

<400> 101
 actgacttgg gaatgtcaaa attctttatt atgatcttcc gagtggtgtc ctgagctttg 60
 ttggccctca actgcaggca gagaaccagg agcagggtgg cagggtctggc cctgaacagg 120
 agctggagca agcgcatgct ngagaaaaca gaaggc 156

<210> 102
 <211> 230
 <212> DNA
 <213> Homo sapien

<220>
 <221> misc_feature
 <222> (1)...(230)
 <223> n = A,T,C or G

<400> 102

```

actccaggcc ggginctcagg ttatcaaaaag tgcaggagct ctgatcagca tggaccactt      60
cttccaaaga atttccctgc tggccggttg taggggttg ggtaattcta taaccagtaa      120
tgtctggggg ggtgctcctc tcccaggaga ctgtgagcac tccagtgtca gggtttgctt      180
ccagatgcaa gntngtnggt ggagacaatg gtgncaccac tttgtnnaca                230

```

<210> 103

<211> 404

<212> DNA

<213> Homo sapien

<220>

<221> misc_feature

<222> (1) ... (404)

<223> n = A,T,C or G

<400> 103

```

actgtgaacc ctgnggnttc nangcgacct acctggagct ggccagtgt gtgaaggagc      60
agtatccggg catcgagatc gagtcgcgcc tcgggggcac aggtgccttt gagatagaga      120
taaattggaca gctgggtgttc tccaagctgg agaattggggg ctttccctat gagaaagatc      180
tcattgaggc catccgaaga gccagtaatg gagaaaccct agaaaagatc accaacagcc      240
gtcctcctcg cgtcatcctg tgaactgcaca ggactctggg ttctgtctct gttctggggg      300
ccaaaccttg gtctcccttt ggtcctgctg ggagctcccc ctgcctcttt cccctactta      360
gctccttagc aaagagaccc tggcctccac tttgcctctt ggggt                    404

```

<210> 104

<211> 404

<212> DNA

<213> Homo sapien

<220>

<221> misc_feature

<222> (1) ... (404)

<223> n = A,T,C or G

<400> 104

```

accaggttat ataatagtat aacactgccca aggagcggat tatctcatct tcctcctgta      60
attccagtgt ttgtcacgtg gttgttgaat aaatgaataa agaattgagaa aaccagaagc      120
tctgatacat aatcataatg ataattatct caatgcacaa ctacgggttg tgctgaacta      180
gaatctatat tttctgaaac tggctcctct aggatctact aatgatttaa atctaaaaga      240
tgaagttagt aaagcatcag aaaaaaaagt gggatttcct acaagtcagg acattctacg      300
tgactataat ataatctcac agaaatttaa cattaatacn ttctaagatt taattcttag      360
antctnggta aacaaagtag ctctgtgga natgattggc atca                    404

```

<210> 105

<211> 325

<212> DNA

<213> Homo sapien

<220>

<221> misc_feature

<222> (1) ... (325)

<223> n = A,T,C or G

<400> 105

```

acagcagaag ccagtctang atgggtgtgat tcaatttctg cctctagtat ttctttgtct      60
tgtttttcct tcaatttaga agtgagcatt gtgttctcag ctatcagaac tttaagctgc      120
ccactatatt gagatgccct tttagctaatt gattcctctt tcagtttttag ggtcatctga      180
agttcagcat tcttttcttt taaaatctta atgtcctcaa agtattttatt ttccttttcc      240

```

tggtagtggg gtttcagngt ggctatattcc agtttttagca tggcaattnc ctttttcaac 300
 atgcaatttt catgtaagag ataata 325

<210> 106
 <211> 444
 <212> DNA
 <213> Homo sapien

 <220>
 <221> misc_feature
 <222> (1)...(444)
 <223> n = A,T,C or G

<400> 106
 actgtcttca atnctatgcg tgcaggtgct taccacaggc aaacagtttt ctccccattt 60
 tgtagtaatg tgattttcct attagcaaaa agaggtcacc agcccttgta gacttaaggg 120
 actcaagtca caggatgggg atttcctctt aatatttttt atttngttgt ttgaactctt 180
 gatgcaacat tgtagagcag ggtgttcagg acctgctgtg cccaaggac tgataaagga 240
 aaaagctcta tttattcttt ttgtgatttg atgcacagat gaaaaactta acacacaata 300
 acagaagttg gncgttaata aatcacatcc taggctttca gcgcttncgt aagcagacga 360
 catcttcagt tttctagctc ttgnagnttc aacacngnaa catcaatgat gcataatgnc 420
 agaatcagtt acaaagacca tccg 444

<210> 107
 <211> 287
 <212> DNA
 <213> Homo sapien

 <220>
 <221> misc_feature
 <222> (1)...(287)
 <223> n = A,T,C or G

<400> 107
 acctgcactc gnacntcagg cantaggcct ccacgtcatg gccaggcact ggcattgggct 60
 ccaccacgtg caggcagttg cagtccttct gggatacatt ctgggttgtaa atgtgcccac 120
 tgatgtttct ataaggtggg acagatgcat ttgcaccgga tatcttcana actcttggtg 180
 gctncagctg ggggcaccaa caaacacccg accacagcca ccaaagataa nagcttcag 240
 cttatcangc ttgctgggcc agnaaagccg gacacctaca agccnc 287

<210> 108
 <211> 478
 <212> DNA
 <213> Homo sapien

<400> 108
 acatgtgcaa gaatttgga aagcagggca ttttccctca tctctcctag agggaatatc 60
 acagcatctg tctctactgg tccacactgg actgcagaca atgtcaaac tctggatttg 120
 gaatgcggct gatttctttt cccctttaag gagttttcca agaatttcat aaccatcagt 180
 tggtatattt ccagcttctt tgatgtcttt ttctataatt tcatagcagt caatgtaaat 240
 cttaacactt tttgaggtca ctacaatatg aaccttgga aaacttccat aaaataatgt 300
 ctttacttct tctgtgtcaa atgtaacagt ttgcaccteg cctcttgtat ccttgtaaaa 360
 gaatgataac gtcttgctag aaggatctgc aatcactcca acttggtggt tgtagtctct 420
 gtctgtgatt tgccaaattg caaaagggtc actgggaggt tctgggagaa gtctgaat 478

<210> 109
 <211> 361
 <212> DNA

<213> Homo sapien

<220>

<221> misc_feature

<222> (1)...(361)

<223> n = A,T,C or G

<400> 109

```

gaatttttct tctanaataa gtattctgtt gacacagact attggttaaga ttttcaacat      60
aaggtaatgc taggactggc ctccatagcat gagttgtgag taaagatctg gtctgttggt      120
tctccaaaag aagnttctta ctgcttgtct ctcatgagtt ttctgtttct gctttctctt      180
tttcatattg atatatacgg ntttttaaatt ggtnattgta attaaatatc tcctcatttt      240
tctcttttag gagatgatgt tgcattttcc tctcaagaaa atgaatatca attgttatct      300
tgcttttgnt gncagcttcc ttatgtgcat gaactaattg ctgttgaagc cacatatttt      360
t

```

<210> 110

<211> 305

<212> DNA

<213> Homo sapien

<220>

<221> misc_feature

<222> (1)...(305)

<223> n = A,T,C or G

<400> 110

```

acataatgac tnncanagtg aagctgattg gctgcggttc tggagtaaat ataagctctc      60
cgttcctggg aatccgcact acttgagtca cgtgcctggc ctaccaaata cttgccaaaa      120
ctatgtgcct tatccacact tnnaatctgn ctccatattt ntcagctggt ggatcagaca      180
atgacattcc tntagatntg gcatcaagc attccanacc tnggccaaact gcaaaccggtg      240
cctncaagga gaaaacgaag gcncaccaa atgnaaaaaa tgaangnccc ttgaatgtac      300
taaaa

```

<210> 111

<211> 371

<212> DNA

<213> Homo sapien

<220>

<221> misc_feature

<222> (1)...(371)

<223> n = A,T,C or G

<400> 111

```

cggggggccag cggggggtat tcagccatcg atcaaactca aaacctggaa tgatatccac      60
tctctttttc ttaagctcag ggaaatatc caagtagaag tccagaaagt catcggctaa      120
gatgcttcgg aatttgaatt catgcacata ggccttgaga aaactgtcaa actgatcctg      180
atcaccacc aagtgggcca ggtatgagac aaagcagaaa cctttctcgt aggggggtctc      240
attataggtg tcgtccgggt caacgcctgg ttcaatcttc acgcggagct tgttgagtgg      300
gttttcctct ccagtgatgt ccatgtgctg acgcagcaga nccgcgcccg ttgcagcctc      360
caagcaggng t

```

<210> 112

<211> 460

<212> DNA

<213> Homo sapien

<220>
 <221> misc_feature
 <222> (1)...(460)
 <223> n = A,T,C or G

<400> 112
 acatcttagg tttttnttcc tttantgtga agaggcggtt ccaccaaccc acagctctgc 60
 gtcgagtttt tactagattg ctgcaaattt catggaatct ttgctgttgt tcagtgggtcc 120
 atttattgga gccaaaaatt ctagggcgct agaattggaa caaggtagtc agccaagcac 180
 aaaaacataa caaaacagga aacgccggac agaacagatg gatctagata gtagataatc 240
 agaaacacca aagaaaccac acccatgatg gcagggtggaa accaggctct ttctcatcgg 300
 aggactttat cagccatcag catcacttct ccccatcctt gcagctgttc ttccagactt 360
 gcagtctctg cagccagcag gttgggtgct gcgattacct ccctccgcca tcgtctcggg 420
 gatgcagtct ctacaagcgc aggccacctc cccaacgagt 460

<210> 113
 <211> 204
 <212> DNA
 <213> Homo sapien

<400> 113
 gagaagacag cagagctgct ttccgcctct ttgagaccaa gatcacccaa gtctctgact 60
 tcaccaagga tgtcaaggcc gctgctaatac agatgcgcaa cttcctgggt cgagcctcct 120
 gccgccttag cttggaacct gggaaagaat atttgatcat ggggtctagat ggggccacct 180
 atgacctcga gggacacccc cagt 204

<210> 114
 <211> 137
 <212> DNA
 <213> Homo sapien

<220>
 <221> misc_feature
 <222> (1)...(137)
 <223> n = A,T,C or G

<400> 114
 accgcaagaa atgggacagc aacgtcattg agacttttga catcgncgcg tngacagtca 60
 acgctgacgt gggctattac tcttgagggt gtcccaagcc cctgaagaac cgtgatgtca 120
 tcaccctccg ntccctg 137

<210> 115
 <211> 278
 <212> DNA
 <213> Homo sapien

<220>
 <221> misc_feature
 <222> (1)...(278)
 <223> n = A,T,C or G

<400> 115
 gcggggcggt ttntggactc gctcatttac agagcatgag tggctctcac ccttggcatg 60
 ttctccgccc gcctctcgga cctcaggcac atgcgaatga cccggagtgt ggacaacgtc 120
 cagntcctgc cctttctcac caggangtc aacaacctgg gctggctgan ttatggggct 180
 ttgaagggag acgggatcct catcgtcanc aacacagtgg gtgctgcgct tcanaccctg 240
 tatatctttg gcatatctgc attactgccc tcggaagc 278

<210> 116
 <211> 178
 <212> DNA
 <213> Homo sapien

<220>
 <221> misc_feature
 <222> (1) ... (178)
 <223> n = A,T,C or G

<400> 116
 acaccgtcat angtcaaaag tncagtgtctg gccatcttgc atcaaagtgtt cttaaggcag 60
 tgactggcta tcaaccacag nttctgtctc cccagntgca aacacaggat ccatgcaaca 120
 gttctgagac catacactta gaaaccacng ggagatgcgg atcanatgca naactnnc 178

<210> 117
 <211> 360
 <212> DNA
 <213> Homo sapien

<220>
 <221> misc_feature
 <222> (1) ... (360)
 <223> n = A,T,C or G

<400> 117
 actccccaat ggnggattta ttactattaa agaaaccagg gaaaatatta attttaatat 60
 tataacaacc tgaaaataat ggaaaagagg tttttgaatt ttttttttaa ataaacacct 120
 tcttaagtgc atgagatggt ttgatggttt gctgcattaa aggtatttgg gcaaacaaaa 180
 ttggagggca agtgactgca gttttgagaa tcagttttga ccttgatgat tttttgtttc 240
 cactgtggaa ataaatgttt gtaaataagt gtaataaaaa tccctttgca ttctttctgg 300
 accttaaatg gtagaggaaa aggctcgtga gccatttgtt tcttttgctg gttatagttg 360

<210> 118
 <211> 125
 <212> DNA
 <213> Homo sapien

<220>
 <221> misc_feature
 <222> (1) ... (125)
 <223> n = A,T,C or G

<400> 118
 gcgtcgtgct atgaccggac ttngtcttga aaggggatga cagcatggga ggcaatggnt 60
 ncacatgtaa accccacact gaaagacaag gcactctctc cacagcagcc ccaacaacta 120
 gccct 125

<210> 119
 <211> 490
 <212> DNA
 <213> Homo sapien

<220>
 <221> misc_feature
 <222> (1) ... (490)
 <223> n = A,T,C or G

```

<400> 119
nacaaagaaa agcaaaaaga atttacgaag attgtgatct cttattaaat caattggtac      60
tgatcatgaa tgtaggttag aaaatgtag gttttaactt aaanaaaatn gtattngat      120
tttcaatntt atgttgaaat cngngtaata tctgangtt nttttcccc cagaagataa      180
agaggataga caacctctta aaatattttt acaatttaat ganaaaaagn ttaaaattct      240
caatacnaat caaacaattt aaatatttta agaaaaaagg aaaagtagat agtgatactg      300
agggtaaaaa aaaattgatt caattttatg gtaaaggaaa cccatgcaat tttacctaga      360
cagccttaaa tatgtctggg tttccatctg ctaggatttc agacatttta tggtcctctt      420
actcaattga taccaacaga aatatcaact tctggagtct attanatgtg ttgtcacctt      480
tctnaagctt                                     490

```

<210> 120

<211> 361

<212> DNA

<213> Homo sapien

<220>

<221> misc_feature

<222> (1) ... (361)

<223> n = A,T,C or G

```

<400> 120
caggtacagt aaaattaaca cttccgttac aggaaatgta tgacgcaaat aatataaaat      60
taaaagggtg aaaaaagggt acactgggtt cctaagatac aatttactct ttacaaccag      120
gggtccacagg tccaggctgc anagcgggca tcaggaagca gagcctncca cctgcttctg      180
ggggacctgg taataaaaat cagcccatga tggcgctatg gcctctcaga caccacacgc      240
tgcctaaaca cctagagctc tggaaatagt caacaggaga gtgatttcca tgggggaaat      300
tttaanaaag atgcacatgg gacaggcaat agaaagtttg ccaaggntaa atttggtacc      360
t                                     361

```

<210> 121

<211> 405

<212> DNA

<213> Homo sapien

<220>

<221> misc_feature

<222> (1) ... (405)

<223> n = A,T,C or G

```

<400> 121
acacaaaacc ttttnacata ttgggggctt accgctccaa attgctactg atcctttaag      60
ttcacaatat agaatttctt caccaattaa gtaataaccc tcattacaaa taaagtgcac      120
ctgataacca aactcgtaag tcccatttgc agggactgct tggccattta aaggatcccg      180
tatatatgga catgtttctc tataacaggc gtcactctgag acaggtagcc atgtatgatt      240
ccgatcacia atagtatggg tggcaagagg aggtatatag aagtatcctt ttttacactt      300
ataatctact cgttcaccaa tctcatagta gggttttggt ttaccaatga gcctccatan      360
cttcaaatgt tgggtggctn ctcacaggca tcnggcanaa ngagt                                     405

```

<210> 122

<211> 152

<212> DNA

<213> Homo sapien

<220>

<221> misc_feature

<222> (1) ... (152)

<223> n = A,T,C or G

<400> 122
 accccgctcc gttgncacag atcgctgtct gccactcca tcggccattc acttggcagg 60
 tgcgattggc agagccccgg agagtgtaac cgtcatagca gtggaaagag atctcatcac 120
 tcacattgta gtagggagac cggggccaan ta 152

<210> 123
 <211> 336
 <212> DNA
 <213> Homo sapien

<400> 123
 acatctgaca tatttatata gcacataaat tagggagtgc tctgaccctt gcccgaggag 60
 cccaagcact gagcagggag gtgaacgccg gtccagaaag aagggtgctg agccccctgt 120
 ctgtcctctc catcacgggg ctccccctagg gcctccccag gcctccttgg ctgagtcag 180
 gtgtctgcag gaggaagggt ttgtctgcat ttagtgtctg agactgggtt tgaggaggca 240
 ccagataaaa ggagatacac ttgcagctat aaagtcagct tcaaacccca gggcttgtaa 300
 ttccaagagg aggggtggga ggcgaggcca tagtct 336

<210> 124
 <211> 253
 <212> DNA
 <213> Homo sapien

<220>
 <221> misc_feature
 <222> (1)...(253)
 <223> n = A,T,C or G

<400> 124
 ctgcaagagc ccagatcacc cattccgggt tcaactcccc cctccccaag tcagcagtc 60
 tagcccaaaa ccagcccaga gcagggtctc tctaaagggg acttgagggc ctgagcagga 120
 aagactggcc ctctagcttc taccctttgt ccctgtagcc tatacagttt agaattatta 180
 tttgttaatt ttattaaaat gctttaaaaa aacaaaaaaa aaaaaaaaaa aaaaaaaaaa 240
 aaaaaagntt gtn 253

<210> 125
 <211> 522
 <212> DNA
 <213> Homo sapien

<400> 125
 acaactgcaa gtctaagata atgttcattc attcccatca taaatgtaac attctaaata 60
 ggtgtcttct gatgtcatct gtcagaattt cttttaaact ttttcttcat cttcaacatt 120
 atcaaagtcc atccttattc ctcttgctt gatttcggag agtttccaat ttttacttta 180
 ttaaggcagc gattgtcttt gcattctctg tatttatctg ctcttcttga aaatttctct 240
 ttgtctcttc gtagaaataa aacttaacag ttggataggc cctgatccca gctttctggc 300
 atgtctgagc ataagcctga cagtctactt ttccagcttt cacttttctt ttaatcatcc 360
 tagccaagag ctcaaattct ggagcaaaat tctggcaagg tccacaccaa ggagcataga 420
 aatcaatcac ccaatgattt ttcccttgta gaacttttct actgaaagtc tgagggtgta 480
 gatctgtgga tacttgaggt aaaaatccta gaccccatgc tc 522

<210> 126
 <211> 374
 <212> DNA
 <213> Homo sapien

<220>

<221> misc_feature
 <222> (1)...(374)
 <223> n = A,T,C or G

<400> 126
 tttttaagat attaacttta cctttataaa tctttgtgtg aaatgaaaaa aaaaatcaag 60
 gcatacaaat ttcattgtgt tctacatttt taaataccat cctttgtctc cgtaaaga 120
 ttttcatecca tttattcaaa aaccttttaa gtccaactgt ccaatttaag acagagtga 180
 gacatttttg agtatctgaa ctaagcattg tcttgactga aacgaagtaa gaactcaatg 240
 agagtccttg tgggcctccc aggcattgct tccgtagat aggggaacttc atctttgttg 300
 gncatcacgc ctgctatgtc taaatgtgcc cacttaggat gagttacgaa ttctttcagg 360
 aatgctgcag ctgt 374

<210> 127
 <211> 130
 <212> DNA
 <213> Homo sapien

<220>
 <221> misc_feature
 <222> (1)...(130)
 <223> n = A,T,C or G

<400> 127
 aaagccaaga cngccattgg cactgctatg gtaaggncac agggcancca gggccttctg 60
 gcaaaaggng atacnaccag cactatnaac agacaggaca tggttgagag gnagnctaca 120
 caantcctaa 130

<210> 128
 <211> 350
 <212> DNA
 <213> Homo sapien

<220>
 <221> misc_feature
 <222> (1)...(350)
 <223> n = A,T,C or G

<400> 128
 aactgattt ccgntnaaaa gaancatcat ctttaccttg acttttcagg gaattactga 60
 actttcttct cagaagatag ggcacagcca ttgccttggc ctcacttgaa gggctctgat 120
 ttgggtcttc tggctctctg ccaagnttcc cagccactcg agggagaaat atcgggaggt 180
 ttgacttctt ccggggcttt cccgagggtc tcaccgtgag ccctgcggcc ctcagggtg 240
 caatcctgga ttcaatgtct gaaacctcgc tctctgcctg ctggacttct gaggccgtca 300
 ctgccactct gtctccagc tetgacagct cctcatctgt ggctgttga 350

<210> 129
 <211> 505
 <212> DNA
 <213> Homo sapien

<220>
 <221> misc_feature
 <222> (1)...(505)
 <223> n = A,T,C or G

<400> 129
 acaataccaa agcttcataa tgctaaagaa aaccaaaca aaagacaatg gtttacacag 60

```

ggaaataacc ctaaggcaat atgaaaacag tcataattta ttactgataa agagtaaagg      120
catccttccc atagaggggg ggaattcaca gggaacacta attatatcag atgaaccacg      180
gggatagaaa ataggcccat ttttaaaatt cattgagaaa ttattacttt ttctccacaa      240
ctgtgattct atacaaaata taaaccctgc aaaccttatg tgctacctga cagataaaaag      300
tagcaggagc cagactcttg aagcacttga gactgatttc tacaaagtcc aggaagagca      360
atgattccag tgtgcagtgc tgatgcatgt gtgagcctaa catgtttatt agctctgggt      420
gcagcccat ctacatgggg cccagttagt ttttagggag tcacagatta ngcaggcaac      480
cgaggggcat gatttaaaaa gcaca                                505

```

<210> 130

<211> 526

<212> DNA

<213> Homo sapien

<400> 130

```

acaaaagagc ctgattcttt ttaattccac aaatacctag catctcaaag taacatgtaa      60
acaaacttct atgctgctca atgaatcctt ccaatttcga taataaacta aatagtattg      120
gatctagtat atgactttca tgtgtaagtt atggttctat ccattacttt aacaatatta      180
ctgatgtaac agagaaaaat tttcaactat tgtacttatt taaaacaaac tgacaagttc      240
aagcacctgt cttcagaaaa gccagcagca tttttttttt tttaacatac tcaaagtaag      300
atttggccta agcccttaat acctttctga acagccatgc aactaaacac cctcaggaga      360
tgttacataa gggagagaag aacatggagc aatttgact tttccccta gataatatta      420
acaaggtaaa gcaaatccag atctttatga atgaatggct gtcattgtta atacacttgg      480
agctctataa aactagagcc actatcatat atgtttatat agatat                                526

```

<210> 131

<211> 477

<212> DNA

<213> Homo sapien

<400> 131

```

ctcagttttc ccagcaacag atgctcctga gcaattttatt agtcaagtga cgggtgctgaa      60
atacttttct cattacatgg aggagaacct catggatggt ggagatctgc ctagtgttac      120
tgatattcga agacctcggc tctacctcct tcagtggcta aaatctgata aggccctaatt      180
gatgctcttt aatgatggca cctttcaggt gaatttctac catgatcata caaaaatcat      240
catctgtagc caaaatgaag aataccttct cacctacatc aatgaggata ggatatctac      300
aactttcagg ctgacaactc tgctgatgtc tggctgttca tcagaattaa aaaattgaat      360
ggaatatgcc ctgaacatgc tcttacaagg atgtaactga aagacttttc gaatggacct      420
tatgggactc ctcttttcca ctgtgagatc tacagggaac ccaaaagaat gatctag      477

```

<210> 132

<211> 404

<212> DNA

<213> Homo sapien

<220>

<221> misc_feature

<222> (1)...(404)

<223> n = A,T,C or G

<400> 132

```

accacacgan cgggnatcnt ttgnacatag tgagaccggg ctgattccca tacatgaatc      60
cattcatgga gtgcatttta ttagatnctt gaaagtcttc atcttcttta tccacctgat      120
caggngcagt tgtaaacatn cctaataatta tcttcaggga gtaaactctc attctcatca      180
aatactgtag gaaacaaata gaattccttg tctacatctt tctgtctccc atttgcatat      240
aaacttcctt tcttgcatat tttcattggc ccaataagcc cagtgaatat atcttttagtg      300
ggatccacag cagaataata catcttagct agacacacag ggatctgcat tacgngggtc      360
ctacttcttt ggggacagcc cttcatacgn gaatgttnt gtgg                                404

```

<210> 133
 <211> 552
 <212> DNA
 <213> Homo sapien

<220>
 <221> misc_feature
 <222> (1)...(552)
 <223> n = A,T,C or G

<400> 133
 accccaaatt atctctctcc tgaagtcctc aacaaacaag gacatggctg tgaatcagac 60
 atttgggccc tgggctgtgt aatgtataca atgttactag ggaggccccc atttgaaact 120
 acaaattctca aagaaactta taggtgcata agggaagcaa ggtatacaat gccgtcctca 180
 ttgctggctc ctgccaaagca cttaattgct agtatgttgc ccaaaaaccc agaggatcgt 240
 cccagtttgg atgacatcat tcgacatgac ttttttttgc agggcttcac tccggacaga 300
 ctgtcttcta gctgttgc tacaagttcca gatttccact tatcaagccc agctaagaat 360
 ttctttaaga aagcagctgc tgctcttttt ggtggcaaaa aagacaaagc aagatatatt 420
 gacacacata atagagtgtc taaagaagat gaagacatct acaagcttag gcatgatttg 480
 aaaaagactt caataactca gcaaccagc aaacacaggg acagatgang agctccacca 540
 cctaccacca ca 552

<210> 134
 <211> 496
 <212> DNA
 <213> Homo sapien

<400> 134
 acattgatgg gctggagagc aggggtggcag cctgttctgc acagaaccaa gaattacaga 60
 aaaaagtcca ggagctggag aggcacaaca tctccttggg agctcagctc cgccagctgc 120
 agacgctaatt tgctcaaact tccaacaaag ctgccagac cagcacttgt gttttgatcc 180
 ttcttttttc cctggctctc atcatcctgc ccagcttcag tccattccag agtcgaccag 240
 aagctgggtc tgaggattac cagcctcacg gagtgacttc cagaaatata ctgaccacaa 300
 aggagtaac agaaaatctg gagaccaag tggtagagtc cagactgacg gagccacctg 360
 gagccaagga tgcattatggc tcaacaagga cactgcttga gaagatggga gggaagccaa 420
 gaccagtggt gcgcattccg tccgtgtctc atgcagatga gatgtgagct ggaacagacc 480
 ttttctgggc cacttt 496

<210> 135
 <211> 560
 <212> DNA
 <213> Homo sapien

<400> 135
 actgggagtg atcactaaca ccatagtaat gtctaataatt cacaggcaga tctgcttggg 60
 gaagctagtt atgtgaaagg caaatagagt catcacagtag ctcaaaaggc aaccataatt 120
 ctcttttggtg caggtcttgg gagcgtgatc tagattacac tgcaccattc ccaagttaat 180
 cccctgaaaa ctactctca actggagcaa atgaactttg gtcccaataa tccatctttt 240
 cagtagcgtt aattatgctc tgtttccaac tgcatttcc tccaattga attaaagtgt 300
 ggctcgttt ttagtcattt aaaattgttt tctaagtaat tgctgcctct attatggcac 360
 ttcaattttg cactgtcttt tgagattcaa gaaaaatttc tattcttttt tttgcatcca 420
 attgtgcctg aacttttaaa atatgtaaat gctgccatgt tccaaaccca tcgtcaagtg 480
 tgtgtgttta gagctgtgca ccctagaaac aacatattgc ccatgagcag gtgcctgaac 540
 acagaccctt ttgcattcac 560

<210> 136
 <211> 424

<212> DNA

<213> Homo sapien

<220>

<221> misc_feature

<222> (1) ... (424)

<223> n = A,T,C or G

<400> 136

```
accagcaaat ctccattagc atttctcagg ttctcatgac cttttcagat atgttggttg      60
atattatgta tatattgctt agaaacaaaa atccacctga tattaataca aacacaaaaa      120
aatcataaaa gcaagcaaat gaacacaaaa ccctagtgtt gttgtgcttt tctttcacat      180
ttcctacagg gagatttgta tatctcagat actttcaaaa tctaataagg aagtaaaatt      240
agtgccttaa ccaaacagta agataccaaa gaatcctcca tcacaagtta ctgaatcaaa      300
cttctcatga catttgcggt atattcagat ttgaagattt tttaaattta gaatttaaaa      360
caaactttag actgctgatt ttccatattt caaagactgt agctgtntgc agcatataaa      420
tgga                                         424
```

<210> 137

<211> 392

<212> DNA

<213> Homo sapien

<220>

<221> misc_feature

<222> (1) ... (392)

<223> n = A,T,C or G

<400> 137

```
tgccgggntg aaggctagca aaccgagcga tcatgtcgca caaacaaatt tactattcgg      60
acaaatacga cgacgaggag tttgagtatc gacatgtcat gctgccaag gacatagcca      120
agctgggccc taaaacccat ctgatgtctg aatctgaatg gaggaatctt ggcgatcagc      180
anagtcaggg atgggtccat tatatgatcc atgaaccaga acctcacatc ttgctgttcc      240
ggcgcccact acccaagaaa ccaaagaaat gaagctggca agctactttt cancctcaag      300
ctttacacag ctgnccttac ttctaacat ctttctgata acattattat gctgccttcc      360
tggtctcact ctganatnta aaagatgttc aa                                         392
```

<210> 138

<211> 284

<212> DNA

<213> Homo sapiens

<220>

<221> misc_feature

<222> (1) ... (284)

<223> n = A,T,C or G

<400> 138

```
tgccctgtgca cctctttgct tgaaatatgg caagacttgg aaaaatgttt gcccttagaa      60
tctatctcac tactttagtt agttgtctcc tttggcctg ggcacagttc tggccctgat      120
ctggaacaga ctcccttttc taaaactgaa cttgaccaca tcaaaagntt gnaaaacaat      180
ctccatggta attaaacttg cattcaacac catatggnaa cagaagatgg caggaggata      240
anatncagat cttatgatct ttccangnan ggcagtgtac atga                                         284
```

<210> 139

<211> 249

<212> DNA

<213> Homo sapiens

<220>

<221> misc_feature

<222> (1)...(249)

<223> n = A,T,C or G

<400> 139

```
gaggaagggg ggactgaatc tancacntg acngaactag agacagccat gggcatgac 60
atagacnnct ttacccgata ntcgggcagc gagggcagca cgcagaccct gaccaagggg 120
gagctcaagg ggctgatgga gaaggagcta ccaggcttcc ngcagagngg aaaaanacaag 180
gangccgtgg ataaattgct caaggaccta gacgccnatg gaggatgccc aggtgggactc 240
cagcgagnt                                     249
```

<210> 140

<211> 390

<212> DNA

<213> Homo sapiens

<220>

<221> misc_feature

<222> (1)...(390)

<223> n = A,T,C or G

<400> 140

```
tcataatggt tggggcagct ataatnnact acaanaatca natgtttcac atctagacct 60
cgggcagcaa cagaggtagc cacaagaagt ttgcangtcc cattcttaaa gtcatttatg 120
atgctatctc tgtcatattg atcaatgcct ccatgaagag acatgcaagg ataagatgct 180
ctcattaaat ccttaagaag accatcagca tgttcctgct tatccacaaa tataatgaca 240
gatcctgact cttgataatg gcctagaagc tcaagtaact tcaagaattt cttttcttct 300
tcaatcacaa tcacttgtn gctccacatct gagcaaacca cactcctgcc tccaacttgt 360
acctgccccg ggcgggcgct caagggcgaa                                     390
```

<210> 141

<211> 420

<212> DNA

<213> Homo sapiens

<220>

<221> misc_feature

<222> (1)...(420)

<223> n = A,T,C or G

<400> 141

```
gacactcagg gaaaagcatn ngncaaanag agcttaaaat gcatcgccaa cggggtcacc 60
tccaaggtct tctcgcctat tcggaggtgc tccactttcc aaaggatgat tgctgaggtg 120
caggaagagt gctacagcaa gctgaatgtg cgcancatcg ccaagcgga cccngaagcc 180
atcactgagg tcgtgcagct gcccaatcac ttctccaaca natactataa cagacttggn 240
cgaagcctgc tggaatgnga tgaanacaca gggcagcaca atcaggagac agcctgatgg 300
anaaaantgg gcctancatg gccaggcctc ttccacatcc tngcangaca gaccactgtg 360
cccaaacaca ccnctgagc tgacttnnac aggagacgca cnaaggagcc cggcagangc 420
```

<210> 142

<211> 371

<212> DNA

<213> Homo sapiens

<400> 142

```

gggttcgaca atgctgatcc gcaattagaa gacactggta agctgtgtta cactgggctt 60
cattgaaatc ttcaaggata tagccagctc ctgctcgaag ctgggattct gtatactgct 120
tggtgaaagg aggaatttcc aaaaattcct cctcttcttc actgcttcct gtaggaccat 180
ctggcagttt ggagcggctg gccaaacttg cactgggttg ggccatggta aggagaaatg 240
cgtagcccag aaacaaggtc ttgttgagag gcaaaggccc tctctgctct tccagggcag 300
agggttcacc ggtgttgtct ccactctcac aggggctcac aaactctcct gcccctactt 360
gcaccaggtt t 371

```

```

<210> 143
<211> 270
<212> DNA
<213> Homo sapiens

```

```

<220>
<221> misc_feature
<222> (1) ... (270)
<223> n = A,T,C or G

```

```

<400> 143
ggtggctgtg atnacctttn ttagtttaca aataaaaaag ntaaaaagaa atactgtgtt 60
tagggtaagg taacannttc atctaatacag aggagagtga agangaggcn ctgccttcta 120
ggnngctgtga ccttctcctt ttcngattc ttcnccacct tgggnaacat ctccccgct 180
atgctggaan tacttcggng ttctgcggtg gccatgntga acatctgatg aactgaaant 240
ncatccnaat gcacacgaag anatagncna 270

```

```

<210> 144
<211> 259
<212> DNA
<213> Homo sapiens

```

```

<220>
<221> misc_feature
<222> (1) ... (259)
<223> n = A,T,C or G

```

```

<400> 144
ttctctttgc tttttataat tttaaagnaa ataacacatt taactgtatt taagtctgtg 60
caaataatcc ttcagaagaa atatccaaga ttctgtttgc agaggtcatt ttgtctctca 120
aagatgatta aatgagtttg tcttcagata aagtgtcctt gtccagnaga actcaaaagg 180
ccttcaagct gttcagtaag tgtagggtca gataagactc cgncatacga attccagctt 240
cccgtgcca ctgtacctc 259

```

```

<210> 145
<211> 433
<212> DNA
<213> Homo sapiens

```

```

<220>
<221> misc_feature
<222> (1) ... (433)
<223> n = A,T,C or G

```

```

<400> 145
accacatnta ccatagtgtg attagtttta attttcacat gaatcaaagg tttcctttca 60
tgtctattta cagtccaatt gtgccaaact cttacttgtg tgctgactaa caaggcattt 120
agggtgtcag catcctagag tgctccaggg cagtgtcagc gttctcggga gtaaaagggtg 180
ccacttggtg gcaatgatat tccagaatta aatgggtttt tggtgccatg gagactgcat 240
ttatataaat gtagcctgta gcttaagtta actaaaccta atgctgctgt taaaaacagt 300

```

```

ttattttaat attaaaatac agttgattag caacagcggg gctgtatttt aagagacact 360
ttattggaag tgcaatcata gttatttggt ttcacaattt tacagngcat tctaattact 420
gatgggtgca att                                     433

```

<210> 146

<211> 576

<212> DNA

<213> Homo sapiens

<400> 146

```

acctcaggcc tgtgcacctc tttgcttgaa atatggcaag acttggaana atgtttgccc 60
ttagaatcta tctcactact ttagttagtt gtctcctttg ggctgggca cagttctggc 120
cctgatctgg aacagactcc cttttctaaa actggacctt gaccacatca aaagtgtgta 180
aaacaatctc catggttaatt aaacttgcat tcaacacccat atggtaacag aagatggcaa 240
aggataagat tcagatctta gatctttcca agtagggcat gttagatgat agaaggatta 300
gttgcaagct ggatctgagc tcaggcttgg gcatgaagga aactgtctcc catgtgggtt 360
ggaagagtta ggggctccct gagctctatt gtgaactata cgggtttcat ccaaggaatg 420
gtatgatgtg ggcataaaaac cattcttcag acaactgaag atgggtcccct tctgtagcca 480
gaaacactag ctgtcctgca ttgccatttc ctttacccca ggcggtcctgc agaaggaaaag 540
gccataatta attaaaaggc ttaatgaagt tttgga                                     576

```

<210> 147

<211> 300

<212> DNA

<213> Homo sapiens

<400> 147

```

ccagcccca ggaggaaggt ggggtctgaat ctagcaccat gacggaacta gagacagcca 60
tgggcatgat catagacgtc tttacccgat attcgggcag cgagggcagc acgcagaccc 120
tgaccaaggg ggagctcaag gtgcttatgg agaaaggagc taccaggctt ctgcagagtg 180
gaaaagacaa ggatgccgtg gataaattgc tcaaggacct agacgccaat ggagatgccc 240
aggtggactt cagtgaattc atcgtgttcg tggctgcaat cacgtctgcc tgtcacaagt 300

```

<210> 148

<211> 371

<212> DNA

<213> Homo sapiens

<400> 148

```

acataatcct cataatggtt ggggcagcta taatttacta caagaatcag atgtttcaca 60
tctagacctc gggcagcaac agaggtagcc acaagaagt tgcaggtccc attcttaaag 120
tcattttatga tgctatctct gtcattatga tcaaattggc tccatgaaga gacatgcaag 180
gataagatgc tctcattaaa tccttaagaa gaccatcagc atgttcctgc ttatccacaa 240
atataatgac agatcctgac tcttgataat ggcctagaag ctcaagtaac ttcaagaatt 300
tcttttcttc ttcaatcaca atcacttggt gctccacatc tgagcaaacc acactcctgc 360
ctccaacttg t                                     371

```

<210> 149

<211> 585

<212> DNA

<213> Homo sapiens

<220>

<221> misc_feature

<222> (1)...(585)

<223> n=A,T,C or G

<400> 149

```

cgaggtacan cactgctaaa tttgacactn anggaaaagc attcgtcaaa gagagcttaa 60
aatgcatcgc caacgggggc acctccaagg tcttctctgc cattcggagg tgctccactt 120
tccaaaggat gattgctgag gtgcaggaag agtgctacag caagctgaat gtgtgcagca 180
tcgccaagcg gaacctgaa gccatcactg aggtcggtcca gctgccaat cacttctcca 240
acagatacta taacagactt gtccgaagcc tgctggaatg tgatgaagac acagtcagca 300
caatcagaga cagcctgatg gagaaaattg ggctaatac ggccagcctc ttccacatcc 360
tgcagacaga ccactgtgcc caaacacacc cactgagctga cttcaacagg agacgcacca 420
atgagccgca gaagctgaaa gtctctctca ggaacctccg aggtgaggag gactctccct 480
cccacatcaa acgcacatcc catgagagtg cataaccagg gagaggntat tcacaacctc 540
ccaaactagt atcatttttag gggnggttga cacaccagt ttgag 585

```

<210> 150

<211> 642

<212> DNA

<213> Homo sapiens

<220>

<221> misc_feature

<222> (1)...(642)

<223> n=A,T,C or G

<400> 150

```

acttnccgggt tcgacaatgc tgatccgcaa ttagaagaca ctggtaagct gtgttacact 60
gggcttcatt gaaatcttca aggatatagc cagctcctgc tcgaagctgg gattctgtat 120
actgcttggt gaaaggagga atttccaaaa attcctctc ttcttactg ctctctgtat 180
gacctctgg cagtttgag cggtggcca acttgactg ggttggtggc atggtaagga 240
gaaatgcgta gccagaaac aaggtcttgt tgagaggcaa aggccctctc tgctcttcca 300
gggcagaggg ttcaccggtg ttgtctccac tctcacagg gctcacaac tctctgccc 360
ctactgcacc aggttttact gtggcagact tgcgacctc cttggcagg gaccgttct 420
cttcagaagt gataagtttt cttttgcctg agagaactcc catggaggca cgaggacttt 480
ctgtgatctt tcgggtaggg gttgtgctgc tactggaggc agtanggggt gctggggagc 540
tgacgttact gcgcgtttc cgcttctct caccaaattg ctaagctgat atctgctgcc 600
tttgtaagaa gnggtactgc ttcatanggg ccaagcccat ac. 642

```

<210> 151

<211> 322

<212> DNA

<213> Homo sapiens

<220>

<221> misc_feature

<222> (1)...(322)

<223> n=A,T,C or G

<400> 151

```

nttgacaac atcttccccg ctatgctgga attacttcgg tgttctgcgg tggccatgg 60
gaacatctga tgaactgaaa ttccatcgga atgcacagga agatatagtt gatcttcaa 120
aatgtccttt ccaggaccac catactgggg aagttctttc ggggtgcctgc naatgggctg 180
caccctgggg ctgggcccga gctctagctc tgtcatgcca tcgccactga aatcggttt 240
cagatgatta gtctcttcat gccccgtcca tttttcggtt tttctccagt gttcagaaat 300
tcaaagtatt aacttctggg aa 322

```

<210> 152

<211> 262
<212> DNA
<213> Homo sapiens

<400> 152
acaaagtctt ctctttgctt tttataattt taaagcaa ataacacattta actgtattta 60
agtctgtgca aataatcctt cagaagaa atccaagatt ctgtttgcag aggtcatttt 120
gtctctcaaa gatgattaaa tgagtttgct tttagaataa agtgctcctg tccagcagaa 180
ctcaaaaggc cttcaagctg ttcagtaagt gtagttcaga taagactccg tcatacgaat 240
tccagcttcc cgtgccct gt 262

<210> 153
<211> 284
<212> DNA
<213> Homo sapiens

<220>
<221> misc_feature
<222> (1)
<223> n=A,T,C or G

<400> 153
ctcgggagta aaaggtgcc cttggtagca atgatattcc agaattaaat gggtttttgt 60
tgccatggag actgcattta tataaatgta gcctgtagct taagttaact aaacctaattg 120
ctgctgttaa aaacagttta ttttaattt aaaatacagt tgattagcaa cagcgggtgct 180
gtattttaag agacacttta ttggaagtgc aatcatagtt atttgttttc acaattttac 240
ngtgcattct aattactgat gggngcaatt acttttaatc gngg 284

<210> 154
<211> 531
<212> DNA
<213> Homo sapiens

<220>
<221> misc_feature
<222> (1)...(531)
<223> n=A,T,C or G

<400> 154
accacccta aatttgaact cttatcaaga ggctgatgaa tctgaccatc aaataggata 60
ggatggacct ttttttgagt tcattgtata aacaaatttt ctgatttgga ctttaattccc 120
aaaggattag gtctactcct gctcattcac tctttcaaag ctctgtccac tctaactttt 180
ctccagtgtc atagataggg aattgctcac tgcgtgccta gtctttcttc acttacctgg 240
cctctgatag aaacagttgc cctctctcatt tcataaggctc gaggacttgt gaccctggat 300
ggttctaaat ggaaaaagca ccgccagatt gtgaaacctg gcttcaacat cagcattctg 360
aaaatattca tcaccatgat gtctgagagt gttcggatga tgctgaacaa atgggaggaa 420
cacattgccc aaaactcacg tctggagctc tttcaacatg tctccctgat gaccctggac 480
agcatcatga agtgtgcctt cagccaccag ggcagcatcc agttngacag t 531

<210> 155
<211> 353
<212> DNA
<213> Homo sapiens

<220>

<221> misc_feature
<222> (1)...(353)
<223> n=A,T,C or G

<400> 155
tcttgacaag actgagagag ttacatgttg ggaaaaaaaa agaagcatta acttagtaga 60
actgaaccag gagcattaag ttctgaaatt ttgaatcatc tctgaaatga agcagggtga 120
gcctgccctc tcatcaatcc gtctgggtgc cagaactcaa ggttcagtgg acacatcccc 180
ctgttagaga ccctcatggg ctaggacttt tcatctagga tagattcaag acctttacct 240
canaattatg taaactgtga ttgtgtttta gaaaaattat tatttgctaa aaccatttaa 300
gtctttgtat atgtgtaaat gatcacaaaa atgtatttta taaaatgttc tgt 353

<210> 156
<211> 169
<212> DNA
<213> Homo sapiens

<400> 156
agtttgttct actacatttg tggccacta gtctactttg ctgtgttgat aagcggtacc 60
accaattgca ctttctatag cctcttttac aatgttgctc acttcatcaa caacaaaagc 120
agtctcctcc gcagcctggg agtcttccat ctttctcctc gcgcgtccc 169

<210> 157
<211> 402
<212> DNA
<213> Homo sapiens

<220>
<221> misc_feature
<222> (1)...(402)
<223> n=A,T,C or G

<400> 157
gttaactacc cgctccgaga cgggattgat gacgagtcct atgaggccat tttcaagccg 60
gtcatgtcca aagtaatgga gatgttccag cctagtgcgg tggctttaca gtgtggctca 120
gactccctat ctggggatcg gttaggntgc tttaactctac tatcaaagga cagcccaagt 180
gtgtggaatt tgtcaagagc tttaacctgc ctatgctgat gctgggaggc ggtggttaca 240
ccattcgtaa cgttgcccgg tgctggacat atgagacagc tgtggccctg gatacggaga 300
tcctaataga gcttccatac aatgactact ttgaatactt tggaccagat ttcaagctcc 360
acatcagtc ttccaacatg actaaccaga acacgaatga gt 402

<210> 158
<211> 546
<212> DNA
<213> Homo sapiens

<400> 158
actttgggct ccagacttca ctgtccttag gcattgaaac catcacctgg tttgcattct 60
tcatgactga ggttaactta aaacaaaaat ggtaggaaag ctttcctatg cttcgggtaa 120
gagacaaatt tgcttttcta gaattgggtg ctgagaaaag cagacagggc ctgattaaag 180
aagacatttg tcaccactag ccaccaagt aagttgtgga acccaaaggt gacggccatg 240
gaaacgtaga tcatcagctc tgctaagtag ttaggggaag aaacatattc aaaccagtct 300
ccaaatggat cctgtgggta cagtgaatga ccactcctgc tttatttttc ctgagattgc 360
cgagaataac atggcactta tactgatggg cagatgacca gatgaacatc atcatcccaa 420
gaatatggaa ccaccgtgct tgcataata gatttttccc tgttatgtag gcattcctgc 480
catccattgg cacttggctc agcacagtta ggccaacaag gacataatag acaagtccaa 540

aacagt

546

<210> 159

<211> 145

<212> DNA

<213> Homo sapiens

<220>

<221> misc_feature

<222> (1)...(145)

<223> n=A,T,C or G

<400> 159

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acttttgcta taagtttcct aaaaatattt aatacttttt tttttcaatt taaattaaat 60
ctnttgatga acaggggggg gntggcaaaa tttccaagcn ctggactgga attttganan 120
aggcatttac ngacctnat aactt 145
```

<210> 160

<211> 405

<212> DNA

<213> Homo sapiens

<400> 160

```
tgtaaatacgc tgtttggatt tcctgatttt ataacagggc ggctgggttaa tatctcacac 60
agtttaaaaa atcagcccct aatttctcca tgtttacact tcaatctgca ggcttcttaa 120
agtgcacagta tcccttaacc tgccaccagt gtccccctc cgccccctgt cttgtaaaaa 180
ggggaggaga attagccaaa cactgtaagc ttttaagaaa acaaaagttt taaacgaaat 240
actgctctgt ccagaggctt taaaactggg gcaattacag caaaaaggga ttctgtagct 300
ttaacttgta aaccacatct tttttgcact ttttttataa gcaaaaacgt gccgtttaaa 360
ccactggatc tatctaaatg ccgatttgag ttcgcgacac tatgt 405
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<210> 161

<211> 443

<212> DNA

<213> Homo sapiens

<220>

<221> misc_feature

<222> (1)...(443)

<223> n=A,T,C or G

<400> 161

```
tttgctttta atgaaggaca agggattaag acncatagag actggccana caaatgggaa 60
accgaccaga ccagcccatg accaaaatat cacaggcaga ccaccacaa atgcagaggc 120
ctcagagtcc acagtgggag gttggaaccc agggccccag ggaatctttc agctgcattc 180
cggctgtgat cggcgggcaa caggtagagg tgctggaggg ggctgagtcg tgattttcgg 240
tgtctgtcat attcgatcaa gtgtgtcata gagcttcctg tttcatctcc cagttattca 300
aggagaggct ggtggctcca cttcccagg aactgtgctg tgaagatctg aagacaggca 360
cgggctcagg caccgcttgt ctggaatgtc aatttgaaac ttaaaaagca gcgaccatcc 420
agtcatttat ttcctccat tcc 443
```

<210> 162

<211> 228

<212> DNA

<213> Homo sapiens

<220>

<221> misc_feature

<222> (1)...(228)

<223> n=A,T,C or G

<400> 162

```
tcgttatcaa aatggaagac accaaacccat tactggcttc taagctgaca gaaaaggagg 60
aagaaatcgt ggactagtgg agtaaatttt atgcttnctc aggggaacat gaaaaatgcg 120
gacagtatat tcagaaaggc tattccnagc tcaagatata tnattgtgaa ctanaaaata 180
tagcanaatt tgagggcctg acagacttct canatacnnt caagttgt 228
```

<210> 163

<211> 580

<212> DNA

<213> Homo sapiens

<220>

<221> misc_feature

<222> (1)...(580)

<223> n=A,T,C or G

<400> 163

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acccaaggct acacatcctt ctgtgaaaca gtctcacgga gactctcaga atccaagaa 60
ttttcttcaa ccttcttttg ttttgattct gaagggaaca tctgatctgc tctcaatggt 120
tgttcattct tcaattccaa ggctttatct ggaacagact ttgcatttca atggcaggct 180
cgaaggcaga tggcttctcg ggaggctctg ctttgaaagt ttgcntgtcc atcaattcta 240
aggctttagn tggaaatagaa actttcattc tgcagggagc cttcagaaaa ccatcattat 300
caggagactc ttctaatttt ccatttatct tatctatttc tttttgatgc gcagccttgg 360
gtanacacac atccttctgt gaaacagtct cacagagact ctcagaatcc caagaacttt 420
cttcatagtc cttttgtttg gattctgatg ggagtatctc atctgctctc aatgtttgtt 480
cattcttcaa ttccaaggct ttatttggaa cagacttttg catttcaatg gcaggctcga 540
aggcagatgg cttctcggga ggctctgctt tgaaaagttg 580
```

210> 164

<211> 140

<212> DNA

<213> Homo sapiens

<220>

<221> misc_feature

<222> (1)...(140)

<223> n=A,T,C or G

<400> 164

```
acttatatct tttggncttg ggcttctcaa agttcacgac agacataggc actctcacag 60
tatcaagccc atttaccgnc acctcacacc aatactcgcc ccaccgngng ataggntctg 120
ctggnaactt taatgnatgn 140
```

<210> 165

<211> 370

<212> DNA

<213> Homo sapiens

<220>
<221> misc_feature
<222> (1)...(370)
<223> n=A,T,C or G

<400> 165
acatggagcc actgccacca gtggtgatgg aaagcactgc cttcttactc cggaagggtc 60
ctttgtcata catggcagcg taagtgtgaag caaactctcc tatgaacact cgctcaaac 120
agcctttcag aatggcaggg actccaaacc actgcnnggg ggaactggaa tatcacaagg 180
tctgcggctt ccagcttctt ttgttcagcc acaatatctg ggctcanatg gncttcttta 240
taagccagaa cagactcggg aggatactga aagttcgcag ggnccctcan ttacctgng 300
atgncctttn tggaaatgat gggattgaag ntcattggnat aaaggncga ctnaccacc 360
tccattcttt 370

<210> 166
<211> 258
<212> DNA
<213> Homo sapiens

<400> 166
gtcaaaaagtc atgatttttta tcttagttct tcattactgc attgaaaagg aaaacctgtc 60
tgagaaaatg cctgacagtt taatttaaaa ctatgggtgta agtctttgac aagaaaaaaa 120
aacaacaaa cacttctttc catcagtaac actggcaatc ttctgttaa ccactctcct 180
tagggatggt atctgaaaca acaatgggtca ccctcttgag attcgtttta agtgtaattc 240
cataatgagc agaggtgt 258

<210> 167
<211> 345
<212> DNA
<213> Homo sapiens

<220>
<221> misc_feature
<222> (1)...(345)
<223> n=A,T,C or G

<400> 167
ggtcagccaa acaccagga tctctgtaaa actgaagaac aggncaatgc caccaacaaa 60
tctcaaaacc tctccagcat attctcctat gattggagca catggngagc acnantggtc 120
acttttaaca canctagcca gacaggngnc atttgggtta acacttcgga acccacagca 180
ntttanantt ctctggatgt catttcgagc acttgatatt attggtcann tttctgtatc 240
tngcgcttgg ttagccctga accaggagca acaggngcag cttctggagg ntggttggaa 300
caatacggca agtgntngaa atgacatcca acctncngaa atgac 345

<210> 168
<211> 61
<212> DNA
<213> Homo sapiens

<400> 168
gatagtgtgg tttatggact gaggtcaaaa tctaagaagt ttcgcagacc tgacatccag 60
t 61

<210> 169

<211> 344
 <212> DNA
 <213> Homo sapiens

<400> 169
 acattggtgc tataaatata aatgctactt atgaagcatg aaattaagct tcttttttct 60
 tcaagttttt tctcttgtct agcaatctgt taggcttctg aaccaagacc aaatgtttac 120
 gttcctctgc tgcataccaa cggtactcca aacaataaaa aatctatcat ttctgctctg 180
 tgctgaggaa tggaaaatga aacccccacc ccctgacccc taggactata cagtggaaac 240
 tgttcattgc tgatgaatgc agcagtcacc aaaaaataca cccaatcttc cagataacct 300
 cagtgcactt taggaaatca aaaattacct ggaagcaatt tagt 344

<210> 170
 <211> 114
 <212> DNA
 <213> Homo sapiens

<400> 170
 agcagtgtgt cctccatgaa taaacaggag ttctggaggc ccatcttctg catcttctgc 60
 tgattgttct tccccaattt tacttaaatc ccacacattc aggcggcggt cagt 114

<210> 171
 <211> 150
 <212> DNA
 <213> Homo sapiens

<220>
 <221> misc_feature
 <222> (1)...(150)
 <223> n=A,T,C or G

<400> 171
 actgagagca tttataatct gaccaaattc ataggcatta ttaggcttgg ctatcggaag 60
 tttctcaggg tcttctggng acctgctgct ttctgcctccc ttctcanaag caaggcatcc 120
 catggagacc tcccctgcag ggcttccagg 150

<210> 172
 <211> 435
 <212> DNA
 <213> Homo sapiens

<220>
 <221> misc_feature
 <222> (1)...(435)
 <223> n=A,T,C or G

<400> 172
 atttgttttc cactgectca cactagtgag ctgtgccaaag tagtagtggt acacctgtgt 60
 tgtcatttcc cacatcacgt aagagcttcc aaggaaagcc aaatcccaga tgagtctcag 120
 agagggatca atatgtccat gattatcttc tggtttaggt ctacagtcaa tgtgatggtg 180
 gtctttgctt ccagctctgc cagaatatct ttgtgcttct ctaatcattg gctttaaagc 240
 taatcaatgt gttggcagca tctctgtcac tcttgtttaa cacgtgaaga aatcaggtag 300
 atttttttct gtggcattgt tttcggacct aaaatcaggt atgctgacta tttccaaggg 360
 gtttttcagt tgcttcattt gcttgtaaag cagggaatcc tcttgntgct tttctttttc 420
 tcgatgagcc cgtgt 435

<210> 173

<211> 622
<212> DNA
<213> Homo sapiens

<220>
<221> misc_feature
<222> (1)...(622)
<223> n=A,T,C or G

<400> 173
actgntttcc cccaagtcca tgacatgtat acataattaa tggtttgcct ccttgattgt 60
tttctccaac atccagacat agaggctgac caacgctttt aatgtatcca gatataacag 120
gattaaggctc tggcacatac acctctggat aaatgttgtt cagataccat gtaaaatttt 180
tacactgaag gcggtgtttt atttcaaate tttttgaaag atcaccaaat gctttttgtt 240
taacaatttt tgctgcatct gtatttctcc tataaaatat ttccttgtat tcatccatcc 300
agacttctgc aaggcgaaact tggtttctag caatcacctg agtgcctttt ggaaagctat 360
gagggctttt gctgcgaaaa acatgtccaa caacagagca aggcataatc tccaactgcc 420
caccacattg ccatactctg aaagacattt ctatatcttc acctcccag atttccattt 480
cttcatcata gcttccaata tactcaaaat attcttttga tatggaaaaa agtcctcctg 540
caaaagtggg tgttttaatt gggtagggtt catctttcct tctttgcttc tcatgatcag 600
gaagcgactt ccaccaatg aa 622

<210> 174
<211> 362
<212> DNA
<213> Homo sapiens

<400> 174
acgggtgcagt tgaccactg ttggtctctc ttgcagttcc tgatatgtca tcttttagcat 60
gtggctactt acgtaatctt acctggacac tttctaactt ttgccgcaac aagaatcctg 120
cacccecgat agatgctgtt gagcagattc ttcctacctt agttcagctc ctgcatcatg 180
atgatccaga agtgtagtca gatacctgct gggctatttc ctaccttact gatggtccaa 240
atgaacgaat tggcatggtg gtgaaaacag gagttgtgcc ccaacttgtg aagcttctag 300
gagcttctga attgccaat gtgactcctg ccctaagagc cataggaat attgtcactg 360
gt 362

<210> 175
<211> 486
<212> DNA
<213> Homo sapiens

<220>
<221> misc_feature
<222> (1)...(486)
<223> n=A,T,C or G

<400> 175
acagntnctc tactacactc agcctcttat gtgccaaagt tttctttaag caatgagaaa 60
ttgctcatgt tcttcatctt ctcaaatac cagaggccga agaaaaacac tttggctgtg 120
tctaaaactt gacacagtca atagaatgaa gaaaattaga gtagttatgt gattatttca 180
gctcttgacc tgtccctctt ggctgcctct gagtctgaat ctcccaaaga gagaaaccaa 240
tttctaagag gactggattg cagaagactc ggggacaaca tttgatccaa gatcttaaat 300
gttatattga taaccatgct cagcaatgag ctattagatt cattttggga aatctccata 360
atttcaattt gtaaactttg ttaagacctg tctacattgt tatatgtgtg tgacttgagt 420
aatgttatca acgtttttgt aaatatctac tatgttttcc tattagctaa attccaacaa 480
ttttgt 486

<210> 176
 <211> 461
 <212> DNA
 <213> Homo sapiens

<400> 176
 accctggcca ctcccttccct tttggctggc caatgtctcc tctgtaggct ccagaaggct 60
 ctcaggggatg caggcggcct cctgcagggt tgagttgcaa tgggaacaaa gacagctgtg 120
 gtcccatagc accctcatct ggtgacatcc tgctactgac agtcaaaaga agccttccca 180
 gatgaaatct tagtcctctg cgcagccatg ctcttcttcc agcaaaagag ccatgtgcag 240
 tcgggtctgc tccccatggg ggctttgatg tgggcccagc agtggatcag ccttccagac 300
 acgctcaact ctgcacactc ttccctgccgc ctcaggcttt ccaggaccct cccgagcctt 360
 atcagagtcct ttaccctcag ggctactgat accttgctgg gtgaccttgg acagattcac 420
 ttacctggac tcagtttcat aatatgaaaa tgatagggtt g 461

<210> 177
 <211> 234
 <212> DNA
 <213> Homo sapiens

<400> 177
 acacattttg taattacctt ttttggtgtt ttgtagcaac catttgtaaa acattccaaa 60
 taattccaca gtccgaagc agcaatcgaa tccctttctc acttttgga ggtgactttt 120
 caccttaatg catattcccc tctccataga ggagaggaaa aggtgtaggc ctgccttacc 180
 gagagccaaa cagagcccag ggagactccg ctgtgggaaa cctcattgtt ctgt 234

<210> 178
 <211> 657
 <212> DNA
 <213> Homo sapiens

<220>
 <221> misc_feature
 <222> (1)...(657)
 <223> n=A,T,C or G

<400> 178
 gagctcggan ccctagtaac ggccgccagg gtgctggnat gngcccttgc gagcgnngcg 60
 cccgggcagg nactttnatc cccctcatc ttccgtagc tcatttgnnt ctctcatttt 120
 ttggcatatt ttccaagtca cacttaaaaa ctcttccatg tattcacttc tcatcacttg 180
 gtctacatgc cgaacctaa gtcaggatc caaaaagatg agtatcctct caaacgcctc 240
 ctaagcctct ggtatacatg actttggctg tgcacttcat ttagacttca cctttttgtt 300
 tgctgttggt ttttactacta gattcctttg tcttcattaa agataatgaa agattcacat 360
 cacagtgcag ctcttcgctt tgcccttctg taagtccgta gcaactgccg agagttcttg 420
 tctgctaggc atgtgtgaaa tccgctttgt ggctctctgt gatttggtcc gcttaacgtt 480
 tttatttgct ttatttacac atgccaaggt ggcaacgtga aaaatgtctc tgacgctatt 540
 ttccgactgt aaagctgagc attcgatata agtagctgct ccaatctgtt tggccatact 600
 tgccccctgg tcataggaca ctggcgctctg cctgtgattg gagagctcta ctaatgt 657

<210> 179
 <211> 182
 <212> DNA
 <213> Homo sapiens

<220>

<221> misc_feature

<222> (1)...(182)

<223> n=A,T,C or G

<400> 179

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acaaaanctt ttaaatttta tattattttg aaactttgct ttgggtttgt ggcaccctgg 60
ccaccccatc tggctgtgac agcctctgca gtccgtgggc tggcagtttg ttgatctttt 120
aagtttcctt ccctaccag tccccatttt ctggtaaggt ttctaggagg tctgttaggt 180
gt
182

```

<210> 180

<211> 525

<212> DNA

<213> Homo sapiens

<400> 180

```

acacgctttt ggccccgacc aatgaggcct tcgagaagat ccctagttag actttgaacc 60
gtatcctggg cgaccacaga gccctgagag acctgctgaa caaccacatc ttgaagtcag 120
ctatgtgtgc tgaagccatc gttgcggggc tgtctgtaga gaccctggag ggcattgacac 180
tggaggtggg ctgcagcggg gacatgctca ctatcaacgg gaaggcgatc atctccaata 240
aagacatcct agccaccaac ggggtgatcc actacattga tgagctactc atcccagact 300
cagccaagac actatttgaa ttggctgcag agtctgatgt gtccacagcc attgaccttt 360
tcagacaagc cggcctcggc aatcatctct ctggaagtga gcggttgacc ctctgggtc 420
ccctgaattc tgtattcaaa gatggaaccc ctccaattga tgcccataca aggaatttgc 480
tcggaacca cataattaaa gaccagctgg cctctaagta tctgt
525

```

<210> 181

<211> 444

<212> DNA

<213> Homo sapiens

<400> 181

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acaccacaat gtgcatcaag gagacgtgcc gattgattcc tgcagtcctg tccatttcca 60
gagatctcag caagccactt accttcccag atggatgcac attgcctgca gggatcaccg 120
tggttcttag tatttggggt ctccaccaca atcctgctgt ctggaaaaac ccaaagggtc 180
ctgaccttct gaggttctct caggagaatt ctgatcagag acacctctat gcctacttac 240
cattctcagc tggatcaagg aactgcattg ggcaggagt tgcctatgatt gagttaaagg 300
taaccattgc cttgattctg ctccacttca gagtgactcc agacccacc aggcctctta 360
ctttccccaa ccattttatc ctcaagccca agaatgggat gtatttgcac ctgaagaaac 420
tctctgaatg ttagatctca gggc
444

```

<210> 182

<211> 441

<212> DNA

<213> Homo sapiens

<400> 182

```

acaaccttta ttgcttctcc agcattttcc agaagaatgg tgtcattaga gggccacagg 60
ggatggggga gtaaaaaata acataaacga actgaacaga aatgcaggag ggtggcaaga 120
ggggccgaga ttgggtgttc agggcagaga ggtggaagac caggggcagt cagtgtctct 180
tagctttcag ccaccagagt ggagaattcg tcaaccccaa ttttgccgtc cccatctttg 240
tctccagcag ccattcagcat cttggtttct ttagcagaca ggtctctggc atctggggag 300
aagcctttta ggatgaatcc cagctcatcc tcctcgatga agccactttg tccttgtcca 360
gcatgtgaaa caccttcttc acatcatccg cactcttttt cttcaggccg accatttgga 420
agaacttttt gtggtcgaag g
441

```

<210> 183
<211> 339
<212> DNA
<213> Homo sapiens

<220>
<221> misc_feature
<222> (1)...(339)
<223> n=A,T,C or G

<400> 183
tgtntcatcn taaggggatt gggctctaga tctgtcgacg gcgcattgag gatttgcnat 60
cggttangtg gtccgcgagt catgaatttt tgctctggag cggtattggt tgtgaagttt 120
atccaggaga gaactatgat tgtgtcgatg cgtttactgc aggaagantc acggctctcag 180
tcacggaggt gtaaggggtg actgactgan tgagacaagg gatatntngt tnttatannc 240
ttgtgatgaa cctgcctacc gtttatgtct ctttgcta at gggctctcng tncgtgnatt 300
cncncaagct gcgggggctt ccnccgttct gggctctga 339

<210> 184
<211> 490
<212> DNA
<213> Homo sapiens

<220>
<221> misc_feature
<222> (1)...(490)
<223> n=A,T,C or G

<400> 184
atatagcaag cttgtacgac cgacacatac ggcgcatgtt gctggattgc ttatcttgtc 60
gcgcgacgtc tatataancg anactacata gtctcggaaa tccactcant ttcaagttcc 120
caaaaanacng ganaaaaaacc catgccttat ttaactaanc atcagctcgc ttctccttct 180
gtaaccgcgc ttntngctcc cagcctatag aagggtaaaa ccacactcg tgcgncagtc 240
atcnnataac tgattcgccc gggactatgcc gggcggcgct cganaccaat tngcanaatt 300
cacacattgc ggcgctcnan aagctctaga aggccaatcg ccatattgat ctatacatta 360
tgggcgcgtc tnacacgtcg tgacgggana ncctggngta ccattaatcg ctgcacantc 420
ccttcgcagc tgggggntac aaaagccgcc catcncacca cgttgcgncc gatggcaagg 480
acnccctnat 490

<210> 185
<211> 368
<212> DNA
<213> Homo sapiens

<220>
<221> misc_feature
<222> (1)...(368)
<223> n=A,T,C or G

<400> 185
ctnnanatag cangcttgta cgaccgacac aatacggcca ntgtgctgga ttcgcttcag 60
cgccgcccgg gcagtaccgg cgctcatcta tcngatgatg gcgcaccaat gtggggtttt 120
aaccttttta tatggctggg gacanaaagc gcgggttacnn aaccnataac gagctgatgg 180
tcatttaaaa atgcttgggg ttttcccggt cttttgggga attgaaactg agtgggactt 240

```

canaaactgt gctactttcg cttatctaag tactcgggcg caacacctag ccgaatccgc 300
anatatcatc acnctggggcg gcgtcancat gcntctaaag ggccaattcn cctanatgag 360
tcttatac                                     368

```

```

<210> 186
<211> 214
<212> DNA
<213> Homo sapiens

```

```

<220>
<221> misc_feature
<222> (1)...(214)
<223> n=A,T,C or G

```

```

<400> 186
ngggagatcg cagcttgtac gactcgatcat ataacggnca atgtgctgga tcgcttcanc 60
gccgccggcg gtctaactcg gttcggattn tgtgtgtntt gtctntntta canggtgcta 120
tcccccttctt cctcctctc tgccatctc atcctttatc tcctttttgg acaagtgtca 180
nancagacag angcagggtg gtggcaccgt tgaa                               214

```

```

<210> 187
<211> 630
<212> DNA
<213> Homo sapiens

```

```

<220>
<221> misc_feature
<222> (1)...(630)
<223> n=A,T,C or G

```

```

<400> 187
cagctgggac gagtcgatca tatacggcgc atgtgttgna tcgctatcgt gtccggcgag 60
tanttattan attactgtta tttctgctcc tactggatat gatctcttga nggcangtct 120
gtgtcgctcg gtcacaccat gttctcaggc tgggcaaata ccttctata atagtttatg 180
gataatgaat gacgactang tctanaana cgctagctaa ataacacact cagggaaaga 240
gtcttaataa ttgtgaaggt gtttttanta tacaacnttt gtttacataa taggaaataa 300
tttttagact tttaaacaga cacttgagcc agatttgta atgttaccat ctatagtgtc 360
ttgaaaatat tcctcttagt ttccaatatg aatgaatcta aaatccatct tttcaattat 420
gccaggcccc gtggtcaatg cncctcnac acttcattaa cggattatac cttgggaaac 480
cataatctgg cntaggacga atcgctggc ncangctaan aactgccctg tattgagggg 540
ttatnnctga ttgcngaggt gcctctccag gtccccaaag ggtcgtactg ttgaanctgg 600
ctctaanttt ntcttgctn acaggctctc                                     630

```

```

<210> 188
<211> 441
<212> DNA
<213> Homo sapiens

```

```

<220>
<221> misc_feature
<222> (1)...(441)
<223> n=A,T,C or G

```

```

<400> 188
cnngcaanac anggtcggat tccgntgagg naanaattcc ctnatagggc tcgcccccta 60

```

```

ttcaccaaac caancngaaa ctcttgcggt caaatctaag ctatnncaca accccactct 120
gnagggtatg cgccccgccc ctgcaatgaa atcaatanca ttttggaga cagagagata 180
gagagagaga ggttcctggc cttnnctatt ctgctcttac ttgnnagatn tcaganatag 240
aaaaacctat cctaggtccn nccaatgatn gcggtctncg aatcccgnng tggccantcc 300
ccggatcgga ctaaatacaa gaagatcctc cgtctcctg ttcctocaca ctggagtcct 360
attgtatgca tgggtntttc actggctnat cataccnag gatctgtcca ccttnaactc 420
ttctctngga antcctncc c 441

```

<210> 189

<211> 637

<212> DNA

<213> Homo sapiens

<220>

<221> misc_feature

<222> (1)...(637)

<223> n=A,T,C or G

<400> 189

```

aggnggtata taccacttg tacnactcga tcatanacgc gcatntctga atcgcttnc 60
ggccgcgatg tactgtgggc acttaagcac tgagtactgt ttgcgtcatg ccnggtcana 120
agatgctgct gcaaagggaac tccaacnaaa tacactgtct tcaacaggag ttaacacctc 180
acacttggtg ganaanagaa ctcaactggg gtgatgcaca cgactgnatc catcaagtgc 240
gtttgcctgt tgactgctaa ccaaggctct ggcagtacct gccggggcgg cgctcgaaac 300
caaatctgca aatatcatca cactggcggn cgctcagcat catctanaag gccatcgct 360
atagtgaagtc tatacatcat ggccgcnttt aactcctac tggaaaaact gcgtaccact 420
taatcgcttc acacatcccc ttctgcngtn gcttatanen aaaagcccac gatgcctcca 480
cattgcncnc tgatggcatg ancccttac gcgcatancc gcggtntgtg taccncangt 540
accgtncctg acgtacnctn tcttctctct cctctctccc ttcccgcttc tcaccattcg 600
gggccttagg tcnatatctc gnccacccaa atntagg 637

```

<210> 190

<211> 653

<212> DNA

<213> Homo sapiens

<220>

<221> misc_feature

<222> (1)...(653)

<223> n=A,T,C or G

<400> 190

```

agggggtata taccacttg tacgactgna tcatatacgc gcatgtctgg aatcgcttnc 60
gtggctgcca tgtattgaca ctacttctaa gaactacaaa agtgatactg angatacatt 120
acacagaang gctnacattc tncagatcc tcatttntca tgatatgtgg acatcangan 180
cacgtggata agtgtatcta aanaatggct ttcaaaatat ttccacttta ttaagggtttg 240
acatganatt cataaaatgt cttaatacta ttctnaaaa taacatctaa tcggaaacta 300
tgccnaact gcacnttttn tgtgtanata atcntanttg tacgcccggc ggcgccaag 360
ccnaatctgc gattcctcac ctggcgccgc tcaacatcat ctaaaggcca atcgctata 420
ntantctata catcctggcc gcgtttacac gtctaattgg aaaccggcgt accacttatc 480
gcttgacgca ctccccttc cactgggtta tacnaaagcc gncgatgcc tcccacattc 540
canctgatgc aatgacctt gtctgcctta ncccgcggtt tgtgtacca ntnaccant 600
cagegctgcn cntcttctt ctcctcttct gccttncgt tccctcactc nng 653

```

<210> 191

<211> 663
 <212> DNA
 <213> Homo sapiens

<220>
 <221> misc_feature
 <222> (1)...(663)
 <223> n=A,T,C or G

<400> 191
 angnggtata taccactgt ncgactcgat catatacgcg catgtcggat cggctccanc 60
 ggcgcggcat gtactatatac tacatcaact gtattatcat ttanatattg atnaaagaca 120
 aatcatact tccatctgct cactgatgat aattactatg atacatgac atgtaaactg 180
 atcaatataa caatggaaga tccctctgac tatgcaagcc taattttcca atcncatgca 240
 ctctcatagc tcaaanatnt cacngacatc ctgatgaaac tatnatacan ttccacaca 300
 aatcacttcg ctttagatct ctccattatt cttgcttttc cccctaaca actacaaatc 360
 ctentgggat gggaagaata tatatcatct actaaaaata atatataatc cctgcanat 420
 ttgtggnaaa tcnggtgtct caanagccac aggagnacaa ggggnacca actaggactt 480
 ttgtatgctt atctctgtac tcgcgcacac ctaagcgatt ctgcnattct cctggcggc 540
 gtcacanctc tanaggccat cncnatatga tctatacatc ntggcgtctt tacactctga 600
 cggaaaccgg gtnccantta cctggacca tcccttcgcn ctgntataca aagccccga 660
 ncc 663

<210> 192
 <211> 361
 <212> DNA
 <213> Homo sapiens

<220>
 <221> misc_feature
 <222> (1)...(361)
 <223> n=A,T,C or G

<400> 192
 antttttata taccactgg tacaactcga ncctatacgg cgcanttneg gaatcanctt 60
 cancgcgcc ggcatgtacc ggtnatcatc atcngatgat ggcgctcnaa tgtgggtttt 120
 acctnttata cggctgagat canatcgct acataacaaa nncaactgat ggtnaatnta 180
 aatncgggtt gggtctccn ntctgttggg gaacttgana ctgagtngc cntccatana 240
 cgtgctattn tcggctancn antctcagc gnacacctat ngnagtgcgc naattcatcc 300
 atgntggcct cgactnttcc aaaangccnt ncgccacnt gntcgcnana cantctcggc 360
 c 361

<210> 193
 <211> 314
 <212> DNA
 <213> Homo sapiens

<220>
 <221> misc_feature
 <222> (1)...(314)
 <223> n=A,T,C or G

<400> 193
 agggngnata taccaactgg tncgactcga tcctatacgc gcatttcgga ttcgcttcaa 60
 cggcgccggc atgtacaaa cctcaatccc aaccgtctca nttngacggg ctgagttctg 120
 tcacagccac cccacatttc tttgttttg tctgcccatt caaaagaatt ccaataaga 180

```

attctgctgc agctccgtac aaggatatgg gcagcacagc acacacagag tngtgctcct 240
cacacttctc tggnaatgtc tcgtgaatat ctcaacagtc angaagtggg gcgttatcaa 300
aaacaatcag ggcc                                     314

```

```

<210> 194
<211> 550
<212> DNA
<213> Homo sapiens

```

```

<220>
<221> misc_feature
<222> (1)...(550)
<223> n=A,T,C or G

```

```

<400> 194
aggngngata taccactgg tncgactcga tcctatacgc gcatgtcggg ncgctatgtg 60
gtcncgcaag tacctcttct gcagtgatgg tctgtntcct ctatgatnag tgatcgaata 120
atcatcgaat tcancgaaag ttattcgagt gatatntgtg gcttgtagaa tctatgctcc 180
atgggtgtgg cactgtcaag attaacacag aatggaagan ncngcactgc ataaaagatg 240
ttgtcaaatt ggggtgcgttg atcngatagc tcntcccaag aggtcantgg tgttcaggat 300
tncnacataa gatnttgat caccngacga ccagangata ccngtgcaaa ctgtgaancn 360
ngtaactctgc ctatncctgc cctctcggan gatccctcgg ggacgacgag atcattctgg 420
aaacagcnan tgatagtcca gtnnangatt gatgancgac ganacgcntg atanatgtct 480
gacgtgagat tnggatgtga atcttcccnt gtgtgacctg cncctaccn aanggtgcgn 540
ctccactcnn                                     550

```

```

<210> 195
<211> 452
<212> DNA
<213> Homo sapiens

```

```

<220>
<221> misc_feature
<222> (1)...(452)
<223> n=A,T,C or G

```

```

<400> 195
nngcgggnat gataccaact ggtacgaact cgantcttat nacggcgctn tttcnngatc 60
tgctatgtgg tctcggcaat gtacattata acngggcana catataatct acntctgtct 120
ttntctcccc cngagagcgc aancatctcc aaatcgggtt ctgggtcatc caatggtctc 180
cantaatcac acaactcata tataattatg gaangtgtct gtcactgtcc ccacgangga 240
agtnncgtcg ctgtntgtct gtcactaggt gngtactctc cagtacttga aancgtgtna 300
nggctgtctg tngtactggc cggcgccctc gaaancgaat ctgtnnatat catcacatng 360
cgncgcccga ncatcactna gggncanttc gcctatactg atcgtntgcg annctgcgn 420
cncttacacg tcgnacggga naccggcctt cc                                     452

```

```

<210> 196
<211> 429
<212> DNA
<213> Homo sapiens

```

```

<220>
<221> misc_feature
<222> (1)...(429)
<223> n=A,T,C or G

```

```

<400> 196
gcggnnnat gataccagct ngtagcactc gatcctataa cggcgcatgt gngtatcggc 60
tacgtgtctc ggcgatgtac atataacggg gcaacatata atnatacant ctgtcttttt 120
ctcccccgga aacggcaacc atctccaata tcggtctggg tctccaatgg tctccaacta 180
aatcacacaa gtcaaatata nttanggaaa gtgtctgtct cntccccaga aggagtancg 240
ttagctgttg tctgtcatta ggttggtacc tccagtnaca tgaaaactgg tgagggtgtc 300
cttgtaacaag ctctgcctca ccagatccta tactattagg ggccccacgg ttatctatct 360
taagggtctn aaaacctgga cttcatctgc tccggcggan gaatgtcccg cttacttacg 420
ntgttccac                                     429

```

```

<210> 197
<211> 471
<212> DNA
<213> Homo sapiens

```

```

<220>
<221> misc_feature
<222> (1)...(471)
<223> n=A,T,C or G

```

```

<400> 197
atgatacgca gctngtacga gccgtcacta tnaaggcnca ttgtgtggat tcngetntga 60
tcggcgcccg ggcagtgtcca tcnagagcgc atcatgggan tgnactcccc atatnntgac 120
caangttcgc gcaaggagcc naganccgat actacctgag ctgtcgtctn gttatacacg 180
tttctggcca angancaact ccacatncaa caagttggtg ttgaaatgtt gtttatnagt 240
ccaccaaccg gccgctctgt cccttcccga tgatccgaag ataagcttcc tgtccggaan 300
acgaacggcg tgggtgtgngg acatantgat atgtgcgggt caggaagtac tcgncgcaac 360
ncgcaagcna atctgcnata tcatcacctg gcggcgctcg agctgccana ngcccnttcg 420
cctatatgag tctatacatt cctggccgctc tnttactctc ngacgggaaa c 471

```

```

<210> 198
<211> 643
<212> DNA
<213> Homo sapiens

```

```

<220>
<221> misc_feature
<222> (1)...(643)
<223> n=A,T,C or G

```

```

<400> 198
tngtncgacc gtcactatac gcccatgtgt ggatccgntc caccggcgccg ggcangtacg 60
anactatatt gatcctctga tattgaaagt tgggtctanca ataaccttta angcaaataca 120
ctcantgagt tttgaccaga agtcaccaca tcatgaatca cagtctatgg caaatgatac 180
cagtgtctct aagtcctatg ctcaaggtaa gagcatgcta ttccgtttta catttactgg 240
aatttactgt tcattcatna ttaaaatctc tagttttcat cctcaactgt ctaanaccag 300
tgtgcacaga cttaaagactc tgttctcctc attttctcca acagaaacat tctcagtgtc 360
tactgttcta aaagggaatt tccgaggtgg cacttctcgg aatatcgacc ctonggctct 420
atcaggcggt acttcnngca ctcgtcattt gggcttggtc anttgtctta tctgtccagt 480
cacttcattt taagaaaaca attgatcgct ggtcacatgt nattcattgg cagccggtgt 540
gactgctgag tctcgcgcac acnctagcaa tcgnnattct ccatggngcg tcaactctcta 600
naggccatcc cctatatgat ctataatctg gcgtctttac act 643

```

```

<210> 199

```

<211> 292
<212> DNA
<213> Homo sapiens

<220>
<221> misc_feature
<222> (1)...(292)
<223> n=A,T,C or G

<400> 199
ncggcnggag ttcgcagttg nacgaccgat cctatacgnc gcattttctga tccgctacnt 60
gtccggcgag tctatgctat ttatttntga ttaaatcaat attttctttc tgaatattaa 120
tcttatctnt actttttatac tattgacctt gctatatgta ttganctttt tgaactccta 180
tcagnttttt tcatgctatc gtatattttc cacttggtac ctntngctga ntcctagata 240
tcgtaaaaca tctctnnatc ntcacacnga gnccagggnt ctgtatngaa tt 292

<210> 200
<211> 275
<212> DNA
<213> Homo sapiens

<220>
<221> misc_feature
<222> (1)...(275)
<223> n=A,T,C or G

<400> 200
atacgcaagc ttggtaccga gctnngatcc ctattaaccg gccgcaatat tctggaattc 60
tgcttancgt ggtcncggcc gaagtactat gctatnttac ttttttgga tataaaatca 120
atatatttct ttctnaagta tataaatctt atccncgtat cnttcnatac ctntctgaca 180
ntaagcttat angtatntga tctntgttga actcctatca agtgntttcn catgctatcg 240
tganntcttc cacnttggtg ccttttacgc tgaat 275

<210> 201
<211> 284
<212> DNA
<213> Homo sapiens

<220>
<221> misc_feature
<222> (1)...(284)
<223> n=A,T,C or G

<400> 201
cgnnnatcca gtgtanaccg tcnttacgcg cattctgac gtacacgcc gcgtctttat 60
atctatctcg actgattcac ctgtcattgt aaanaattcg tgtcagctgt ctaccnctta 120
nacatcatct aatcnaacta ncctgataaa tttcttcaat agggatanac ntntagtaca 180
tacgnttcca ttgagntacn tccgcggacc cncatcgcaa acnncatgcy gtcagtcnna 240
gcatccteta tcttaatccg tccttacnt ntgaacgctc cact 284

<210> 202
<211> 448
<212> DNA
<213> Homo sapiens

<220>

<221> misc_feature

<222> (1)...(448)

<223> n=A,T,C or G

<400> 202

```
atgatacgca agcttgtagc actcggatca tataacggcc gcaatgtgct ggaattccgc 60
ttcgacggac gccgggcatg tacttttata atnctactcc tcagacctg catctcnacc 120
gctnggtcca gtttgtaaaa acnnacttcc gtngtgcagc cctgggtctg ancantctct 180
atcacnctct atcctcncat ccncaanact anatcgctg aattcatatt tattcatttt 240
ccataatgat gggggaanga ctatcnctna tnatgcttan cacnctngct gcanttcgnc 300
natctcgcn a ngcntgaaac gattactctg tcgcgaaccc tctangntga attctgcnaa 360
atatctntna cncctggcngg cgctcnangn atgcctctcg anggccaatc cgccnngcat 420
gattctaatt anaccntng gtcccntt 448
```

<210> 203

<211> 321

<212> DNA

<213> Homo sapiens

<220>

<221> misc_feature

<222> (1)...(321)

<223> n=A,T,C or G

<400> 203

```
gggtgcnaga tcgcagtngt acgaatcgnt catatacggc gcatgtgntg antcgctacg 60
tgtccggcga ngtagcatat aatcgaanta ncatagttct ggangeccnc tcattttcaa 120
tttcccaaaa nacgggaaaa ccnaagcctt atttaactaa ctatctgctc gcttctcgct 180
tctgtaccgc gctatntgct nccagcctat aanaagggtg aaacccacac tcggtgcgctc 240
agtctccnat atantgagtc nccgggtact ggccggggcg tcgttcnaaa ncaattcncg 300
aanttcacta ctggcggcgc c 321
```

<210> 204

<211> 369

<212> DNA

<213> Homo sapiens

<220>

<221> misc_feature

<222> (1)...(369)

<223> n=A,T,C or G

<400> 204

```
ntgtngtatg taccagtggt tacgactcga tcctagtacg gcgcagtgtg ctgaatcggt 60
acttgctcgc gccaaagtatc tataaagcaa actatcacag ttctgaaagt ccatctcant 120
ttcagttccc aaaaganegg gaaaacccaa gccttattaa actaacaatc agtcgctctc 180
gcttctgtac cgcgcttttg gccccagcc tataaaaggg taaaaccac actcgggtgcg 240
ccagtcacgc ataactgaat cgcccgttac tgcccggcg gcgctcnann ccaaactcgc 300
agatatcaca cactggcggc gctcancatg ctctagaagg ccaattcncc tatantgatt 360
ctattacaa 369
```

<210> 205

<211> 2996

<212> DNA

<213> Homo sapien

<400> 205

| | | | | | | |
|-------------|------------|-------------|-------------|-------------|-------------|------|
| cagccaccgg | agtggatgcc | atctgcaccc | accgccctga | ccccacaggc | cctgggctgg | 60 |
| acagagagca | gctgtatttg | gagctgagcc | agctgaccca | cagcatcact | gagctgggcc | 120 |
| cctacaccct | ggacagggac | agtctctatg | tcaatggttt | cacacagcgg | agctctgtgc | 180 |
| ccaccactag | catttctggg | acccccacag | tggacctggg | aacatctggg | actccagttt | 240 |
| ctaaacctgg | tccctcggtc | gccagccctc | tcttggtgct | attcactctc | aacttcacca | 300 |
| tcaccaacct | gcggtatgag | gagaacatgc | agcaccctgg | ctccaggaag | ttcaacacca | 360 |
| cggagagggt | ccttcagggc | ctgggtccctg | ttcaagagca | ccagtgttgg | ccctctgtac | 420 |
| tctggctgca | gactgacttt | gctcaggcct | gaaaaggatg | ggacagccac | tggagtggat | 480 |
| gccatctgca | cccaccaccc | tgaccccaaa | agccctaggg | tggacagaga | gcagctgtat | 540 |
| tgggagctga | gccagctgac | ccacaatatc | actgagctgg | gcccctatgc | cctggacaac | 600 |
| gacagcctct | ttgtcaatgg | tttcaactcat | cggagctctg | tgctccaccac | cagcactcct | 660 |
| gggaccccc | cagtgtatct | gggagcatct | aagactccag | cctcgatatt | tggcccttca | 720 |
| gctgccagcc | atctcctgat | actattcacc | ctcaacttca | ccatcactaa | cctgcgggtat | 780 |
| ggctccctca | agttcaacat | ctccaggaag | ttcaacacta | cagagagggt | ccttcagggc | 840 |
| ctgctaaggc | ccttgttcaa | gaacaccagt | gttggccctc | tgtactctgg | ctgcaggctg | 900 |
| accttgctca | ggccagagaa | agatggggaa | gccaccggag | tggatgccat | ctgcacccac | 960 |
| cgccctgacc | ccacaggccc | tgggctggac | agagagcagc | tgtatttgga | gctgagccag | 1020 |
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<212> PRT

<213> Homo sapien

<400> 206

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| Leu | Gly | Pro | Pro | Gln | Trp | Thr | Trp | Glu | His | Leu | Gly | Leu | Gln | Phe | Leu |
| | | | 20 | | | | | 25 | | | | | 30 | | |
| Asn | Leu | Val | Pro | Arg | Leu | Pro | Ala | Leu | Ser | Trp | Cys | Tyr | Ser | Leu | Ser |
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| Thr | Ser | Pro | Ser | Pro | Thr | Cys | Gly | Met | Arg | Arg | Thr | Cys | Ser | Thr | Leu |
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| Ala | Pro | Gly | Ser | Ser | Thr | Pro | Arg | Arg | Gly | Ser | Phe | Arg | Ala | Trp | Ser |
| 65 | | | | | 70 | | | | | 75 | | | | 80 | |
| Leu | Phe | Lys | Ser | Thr | Ser | Val | Gly | Pro | Leu | Tyr | Ser | Gly | Cys | Arg | Leu |
| | | | | 85 | | | | 90 | | | | | | 95 | |
| Thr | Leu | Leu | Arg | Pro | Glu | Lys | Asp | Gly | Thr | Ala | Thr | Gly | Val | Asp | Ala |
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| Ile | Cys | Thr | His | His | Pro | Asp | Pro | Lys | Ser | Pro | Arg | Leu | Asp | Arg | Glu |
| | | 115 | | | | | 120 | | | | | 125 | | | |
| Gln | Leu | Tyr | Trp | Glu | Leu | Ser | Gln | Leu | Thr | His | Asn | Ile | Thr | Glu | Leu |
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| Gly | Pro | Tyr | Ala | Leu | Asp | Asn | Asp | Ser | Leu | Phe | Val | Asn | Gly | Phe | Thr |
| 145 | | | | | 150 | | | | | 155 | | | | 160 | |
| His | Arg | Ser | Ser | Val | Ser | Thr | Thr | Ser | Thr | Pro | Gly | Thr | Pro | Thr | Val |
| | | | | 165 | | | | | 170 | | | | | 175 | |
| Tyr | Leu | Gly | Ala | Ser | Lys | Thr | Pro | Ala | Ser | Ile | Phe | Gly | Pro | Ser | Ala |
| | | | 180 | | | | | 185 | | | | | 190 | | |
| Ala | Ser | His | Leu | Leu | Ile | Leu | Phe | Thr | Leu | Asn | Phe | Thr | Ile | Thr | Asn |
| | | 195 | | | | | 200 | | | | | 205 | | | |
| Leu | Arg | Tyr | Glu | Glu | Asn | Met | Trp | Pro | Gly | Ser | Arg | Lys | Phe | Asn | Thr |
| | 210 | | | | | 215 | | | | | 220 | | | | |
| Thr | Glu | Arg | Val | Leu | Gln | Gly | Leu | Leu | Arg | Pro | Leu | Phe | Lys | Asn | Thr |
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| Ser | Val | Gly | Pro | Leu | Tyr | Ser | Gly | Cys | Arg | Leu | Thr | Leu | Leu | Arg | Pro |
| | | | | 245 | | | | 250 | | | | | | 255 | |
| Glu | Lys | Asp | Gly | Glu | Ala | Thr | Gly | Val | Asp | Ala | Ile | Cys | Thr | His | Arg |
| | | | 260 | | | | | 265 | | | | | 270 | | |
| Pro | Asp | Pro | Thr | Gly | Pro | Gly | Leu | Asp | Arg | Glu | Gln | Leu | Tyr | Leu | Glu |
| | | 275 | | | | | 280 | | | | | 285 | | | |
| Leu | Ser | Gln | Leu | Thr | His | Ser | Ile | Thr | Glu | Leu | Gly | Pro | Tyr | Thr | Leu |
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| Asp | Arg | Asp | Ser | Leu | Tyr | Val | Asn | Gly | Phe | Thr | His | Arg | Ser | Ser | Val |
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| Pro | Thr | Thr | Ser | Thr | Gly | Val | Val | Ser | Glu | Pro | Phe | Thr | Leu | Asn | |
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| Phe | Thr | Ile | Asn | Asn | Leu | Arg | Tyr | Met | Ala | Asp | Met | Gly | Gln | Pro | Gly |
| | | | 340 | | | | | 345 | | | | | 350 | | |
| Ser | Leu | Lys | Phe | Asn | Ile | Thr | Asp | Asn | Val | Met | Lys | His | Leu | Leu | Ser |
| | | 355 | | | | | 360 | | | | | 365 | | | |
| Pro | Leu | Phe | Gln | Arg | Ser | Ser | Leu | Gly | Ala | Arg | Tyr | Thr | Gly | Cys | Arg |
| | 370 | | | | | 375 | | | | | 380 | | | | |
| Val | Ile | Ala | Leu | Arg | Ser | Val | Lys | Asn | Gly | Ala | Glu | Thr | Arg | Val | Asp |
| 385 | | | | | 390 | | | | | 395 | | | | 400 | |
| Leu | Leu | Cys | Thr | Tyr | Leu | Gln | Pro | Leu | Ser | Gly | Pro | Gly | Leu | Pro | Ile |
| | | | 405 | | | | | 410 | | | | | 415 | | |
| Lys | Gln | Val | Phe | His | Glu | Leu | Ser | Gln | Gln | Thr | His | Gly | Ile | Thr | Arg |
| | | 420 | | | | | | 425 | | | | | 430 | | |
| Leu | Gly | Pro | Tyr | Ser | Leu | Asp | Lys | Asp | Ser | Leu | Tyr | Leu | Asn | Gly | Tyr |
| | | 435 | | | | | 440 | | | | | 445 | | | |
| Asn | Glu | Pro | Gly | Pro | Asp | Glu | Pro | Pro | Thr | Thr | Pro | Lys | Pro | Ala | Thr |

| | | | | | | | | | | | | | | | | |
|---------|-----|-----|-----|-----|-----|---------|-----|-----|-----|-----|-----|-----|-----|-----|---------|--|
| | 450 | | | | | 455 | | | | | 460 | | | | | |
| Thr 465 | Phe | Leu | Pro | Pro | Leu | Ser 470 | Glu | Ala | Thr | Thr | Ala | Met | Gly | Tyr | His 480 | |
| Leu | Lys | Thr | Leu | Thr | Leu | Asn | Phe | Thr | Ile | Ser | Asn | Leu | Gln | Tyr | Ser | |
| | | | | | 485 | | | | 490 | | | | | | 495 | |
| Pro | Asp | Met | Gly | Lys | Gly | Ser | Ala | Thr | Phe | Asn | Ser | Thr | Glu | Gly | Val | |
| | | | 500 | | | | | 505 | | | | | 510 | | | |
| Leu | Gln | His | Leu | Leu | Arg | Pro | Leu | Phe | Gln | Lys | Ser | Ser | Met | Gly | Pro | |
| | | 515 | | | | | 520 | | | | | 525 | | | | |
| Phe | Tyr | Leu | Gly | Cys | Gln | Leu | Ile | Ser | Leu | Arg | Pro | Glu | Lys | Asp | Gly | |
| | 530 | | | | | 535 | | | | | 540 | | | | | |
| Ala | Ala | Thr | Gly | Val | Asp | Thr | Thr | Cys | Thr | Tyr | His | Pro | Asp | Pro | Val | |
| 545 | | | | | 550 | | | | | 555 | | | | | 560 | |
| Gly | Pro | Gly | Leu | Asp | Ile | Gln | Gln | Leu | Tyr | Trp | Glu | Leu | Ser | Gln | Leu | |
| | | | | 565 | | | | | 570 | | | | | 575 | | |
| Thr | His | Gly | Val | Thr | Gln | Leu | Gly | Phe | Tyr | Val | Leu | Asp | Arg | Asp | Ser | |
| | | | 580 | | | | | 585 | | | | | 590 | | | |
| Leu | Phe | Ile | Asn | Gly | Tyr | Ala | Pro | Gln | Asn | Leu | Ser | Ile | Arg | Gly | Glu | |
| | | 595 | | | | | 600 | | | | | 605 | | | | |
| Tyr | Gln | Ile | Asn | Phe | His | Ile | Val | Asn | Trp | Asn | Leu | Ser | Asn | Pro | Asp | |
| | 610 | | | | | 615 | | | | | 620 | | | | | |
| Pro | Thr | Ser | Ser | Glu | Tyr | Ile | Thr | Leu | Leu | Arg | Asp | Ile | Gln | Asp | Lys | |
| 625 | | | | 630 | | | | | | 635 | | | | | 640 | |
| Val | Thr | Thr | Leu | Tyr | Lys | Gly | Ser | Gln | Leu | His | Asp | Thr | Phe | Arg | Phe | |
| | | | | 645 | | | | | 650 | | | | | 655 | | |
| Cys | Leu | Val | Thr | Asn | Leu | Thr | Met | Asp | Ser | Val | Leu | Val | Thr | Val | Lys | |
| | | | 660 | | | | | 665 | | | | | 670 | | | |
| Ala | Leu | Phe | Ser | Ser | Asn | Leu | Asp | Pro | Ser | Leu | Val | Glu | Gln | Val | Phe | |
| | | 675 | | | | | 680 | | | | | 685 | | | | |
| Leu | Asp | Lys | Thr | Leu | Asn | Ala | Ser | Phe | His | Trp | Leu | Gly | Ser | Thr | Tyr | |
| | 690 | | | | | 695 | | | | | 700 | | | | | |
| Gln | Leu | Val | Asp | Ile | His | Val | Thr | Glu | Met | Glu | Ser | Ser | Val | Tyr | Gln | |
| 705 | | | | 710 | | | | | | 715 | | | | | 720 | |
| Pro | Thr | Ser | Ser | Ser | Ser | Thr | Gln | His | Phe | Tyr | Leu | Asn | Phe | Thr | Ile | |
| | | | | 725 | | | | | 730 | | | | | 735 | | |
| Thr | Asn | Leu | Pro | Tyr | Ser | Gln | Asp | Lys | Ala | Gln | Pro | Gly | Thr | Thr | Asn | |
| | | | 740 | | | | | 745 | | | | | 750 | | | |
| Tyr | Gln | Arg | Asn | Lys | Arg | Asn | Ile | Glu | Asp | Ala | Leu | Asn | Gln | Leu | Phe | |
| | | 755 | | | | | 760 | | | | | 765 | | | | |
| Arg | Asn | Ser | Ser | Ile | Lys | Ser | Tyr | Phe | Ser | Asp | Cys | Gln | Val | Ser | Thr | |
| | 770 | | | | | 775 | | | | | 780 | | | | | |
| Phe | Arg | Ser | Val | Pro | Asn | Arg | His | His | Thr | Gly | Val | Asp | Ser | Leu | Cys | |
| 785 | | | | 790 | | | | | | 795 | | | | | 800 | |
| Asn | Phe | Ser | Pro | Leu | Ala | Arg | Arg | Val | Asp | Arg | Val | Ala | Ile | Tyr | Glu | |
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Gly Arg His Ser Ile Thr Val Thr Thr Val Ala Ser Ala Gly Asn Ile
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Gly Glu Asp Gly Ile Leu Ser Cys Thr Phe Glu Pro Asp Ile Lys Leu
      50              55              60

Ser Asp Ile Val Ile Gln Trp Leu Lys Glu Gly Val Leu Gly Leu Val
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His Glu Phe Lys Glu Gly Lys Asp Glu Leu Ser Glu Gln Asp Glu Met
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Phe Arg Gly Arg Thr Ala Val Phe Ala Asp Gln Val Ile Val Gly Asn
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Lys Cys Tyr Ile Ile Thr Ser Lys Gly Lys Gly Asn Ala Asn Leu Glu
      130             135             140

Tyr Lys Thr Gly Ala Phe Ser Met Pro Glu Val Asn Val Asp Tyr Asn
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Ala Ser Ser Glu Thr Leu Arg Cys Glu Ala Pro Arg Trp Phe Pro Gln
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Pro Thr Val Val Trp Ala Ser Gln Val Asp Gln Gly Ala Asn Phe Ser
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Glu Val Ser Asn Thr Ser Phe Glu Leu Asn Ser Glu Asn Val Thr Met
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Lys Val Val Ser Val Leu Tyr Asn Val Thr Ile Asn Asn Thr Tyr Ser
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Cys Met Ile Glu Asn Asp Ile Ala Lys Ala Thr Gly Asp Ile Lys Val
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Thr Glu Ser Glu Ile Lys Arg Arg Ser His Leu Gln Leu Leu Asn Ser
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Leu Pro Leu Ser Pro Tyr Leu Met Leu Lys
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Gln Ile Leu Phe Trp Ser Ile Ile Ser Ile Ile Ile Ile Leu Ala Gly
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Ala Ile Ala Leu Ile Ile Gly Phe Gly Ile Ser Gly Arg His Ser Ile
      50                      55                      60

Thr Val Thr Thr Val Ala Ser Ala Gly Asn Ile Gly Glu Asp Gly Ile
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Leu Ser Cys Thr Phe Glu Pro Asp Ile Lys Leu Ser Asp Ile Val Ile
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Gln Trp Leu Lys Glu Gly Val Leu Gly Leu Val His Glu Phe Lys Glu
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Gly Lys Asp Glu Leu Ser Glu Gln Asp Glu Met Phe Arg Gly Arg Thr
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Ala Val Phe Ala Asp Gln Val Ile Val Gly Asn Ala Ser Leu Arg Leu
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Lys Asn Val Gln Leu Thr Asp Ala Gly Thr Tyr Lys Cys Tyr Ile Ile
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Thr Ser Lys Gly Lys Gly Asn Ala Asn Leu Glu Tyr Lys Thr Gly Ala
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Ala Ser Gln Val Asp Gln Gly Ala Asn Phe Ser Glu Val Ser Asn Thr
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Ser Phe Glu Leu Asn Ser Glu Asn Val Thr Met Lys Val Val Ser Val
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Leu Tyr Asn Val Thr Ile Asn Asn Thr Tyr Ser Cys Met Ile Glu Asn
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Asp Ile Ala Lys Ala Thr Gly Asp Ile Lys Val Thr Glu Ser Glu Ile
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Lys Arg Arg Ser His Leu Gln Leu Leu Asn Ser Lys Ala Ser Leu Cys
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Tyr Leu Met Leu Lys
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 tttgtatta atgtaccta atttctact gangtggtct agaagctcct ccgccattgc 600
 ccttgccgcc agcaaatttt tatccctagg gttaagataa cagaaggcan ccttgggcct 660
 tgctgccac attctcaggt ntncactgaa gcacagtatc tatttctcca aaaatagggg 720
 ctgtnaactt gttactaccc cc 742

<210> 211
 <211> 946
 <212> DNA
 <213> Homo sapiens

<220>
 <221> misc_feature
 <222> (1)...(946)
 <223> n=A,T,C or G

<400> 211
 ggcacgaggc acatcgctgg atttctcatt gccaaagctct attaatcat tctttttcat 60
 aacctcttat tcttatttca tggatgcaac attttctttg tctctcaggg aataataatt 120
 attcctactt ttaaaggctt aatttcttta ttactttatt tctctgggag tgagtttttc 180
 ctaaagggat aatgagatgg aaaatgaaaa aacaaagtgt agacatggag ataccttctg 240
 aaactcaagc attcctctac gtggatgtgc cagagggaaa gaacagaaca aaggagggtg 300
 gacactattt aaataaaaa atataagaat attacataac aaacaaaaaa gcccaaatcc 360
 tcaggttgaa aaggaggaga aaatgtcaag caagacaaaa acagatgaag caacccaaaa 420
 agtgacatag ctggtcacct atattgaaat ttcagaacat gagtgataaa ggactcccag 480
 aaaaaaacaa aacccaaact aaaaaacaga aaaaaaggac tttaccaccn aaaacttgan 540
 gaatcaggaa gactcagtct ctcatgaaga aaantgctat aggggatggg ggcaaggcct 600
 tcaaagtngc aggggatacc aataacctct ctgaagtgtt ggaacttcat actccaaaat 660
 ngaatttttg tttgaatagc cccggttagg ggccaatttt aggacttaga aaggaccng 720
 gnaaatcatt cccncttgc ccccccgaa agaaattaat agaaggggtt tattcccgcc 780
 attannaaaa aaggaatcca ggaattnccg nttttttcca gtgttangnt gggngtgan 840

aaactgaggg cttagcaagg gcggnattaa ccacccnggg tcccacccca aaantggngng 900
gggtggggccc caaatccggg nttnttncct ttaangcggt aaaccc 946

<210> 212
<211> 610
<212> DNA
<213> Homo sapiens

<220>
<221> misc_feature
<222> (1)...(610)
<223> n=A,T,C or G

<400> 212
ggcacgaggt ttctggctgg agcctcggac actggctcac tgcagttggt ggtgtcgaca 60
gtggtangag ggcaaccagt aacgggagct tctcctgccca ggaggaaga cgagtagaag 120
ggagcggcat gctggaggct ggagcctgag cccctggggc tcgccttgct gtgtttggtg 180
gtgacgtggg aactgcagc tcggccagag tggtaaaaaa tgccttggtg tacgcttttc 240
tggctttgcc cgtctatctg ctccaagcca ggctgganga ngagganaag gaatcacctg 300
tggtacgctg gagcctgcat gtggcggtgac tctgcaactc gcctcgtgtg actgatggca 360
gccacggaga ctgcagctcg acagggagtg aggcttctca ntggcttgaa agctcagctg 420
actcccacga aatttgccgg aaactcaagg ctgtcagtgga cnttcgtggc gccaaagactt 480
aancangcgc gttgcatgca tccggccagt gtctgtgccca cgtgccctga cnccaccttg 540
anataancac ccggaacgcg cnnccgcgcag gccgcgcgca cacgnccggg cancaacttg 600
gctggcttcc 610

<210> 213
<211> 438
<212> DNA
<213> Homo sapiens

<220>
<221> misc_feature
<222> (1)...(438)
<223> n=A,T,C or G

<400> 213
ccganagcgg tttaaacggg ccctctagac tcgagcggcc gccctttttt tttttttttg 60
aaataaattt ctagattatt tattacataa gcagaccact gaaacattta ttcaaaagta 120
ttccattgag agtcaaaaac atattgatat gattattatt ggtctgttaa agaaaacaaa 180
ataaaaagaa caaactggga attatcaata aacaaatcaa aacttagatg taattataac 240
ctaaagggct cacagggcaa atgtgaagca agcttctgtc tcagagcctg catatggaag 300
acatgtagta cttagctttg gcatctttct ttcctcctct tggttgagtt taagtattaa 360
taaaaggtgg actgagaaaa ccttttttta caatcttatg gggatattttt agtggaacg 420
ttttagaagt aggaatat 438

<210> 214
<211> 906
<212> DNA
<213> Homo sapiens

<220>
<221> misc_feature
<222> (1)...(906)
<223> n=A,T,C or G

```

<400> 214
gccctctaga tcgngcggcc gccctttttt tttttttttt gaaataaatt tctagattat 60
ttattacata agcagaccac tgaaacattt attcaaaagt attccattga gagtcaaaaa 120
catattgata tgattattat tggctctgta aagaaaacaa aataaaaaga acaaactggg 180
aattatcaat aaacaaatca aaacttagat gtaattataa cctaaagggc tcacagggca 240
aatgtgaagc aagcttctgt ctcagagcct gcatatggaa gacatgtagt acttagcttt 300
gncatctttc tttcctcctc ttgnttgagt ttagtattaa taaaagttgg actgagaaaa 360
ccttttttta caatcttatg gggtattttt agtggaacg tttagaagta gaataacat 420
attaaaactg cncagaacaa atgnggtgca tctcaaatgg nggtccattt tcaaaatatg 480
aacacatatg ggcagcantt ttttttttaa aaagtcagaa ggggcctnct catgccccct 540
tccacttctt cactcattgg nccttcaacc caagcttaac tactntcctg acctccaaca 600
tcataaacta gtttccnagc tttgaaactt ttttccaatg agtontaccg gaatagatgn 660
tcacagaanc ctcttaaaaa ttttggaccc tgcccgggnt ntaaaaaggg tgcaataaac 720
ccaccaacat cttggctggg ggggcagggg ccaaaagaan ttcccaaac cgtttttgat 780
naaaaaaggg gacttttgaa aaaaaaatta aaatttttgc cagnaaagca tgggnccccc 840
cccttgaana aacccctgc atnaaaccaa cntntggga ntttttngg tanggtttt 900
ctggct                                     906

```

```

<210> 215
<211> 312
<212> DNA
<213> Homo sapiens

```

```

<220>
<221> misc_feature
<222> (1)...(312)
<223> n=A,T,C or G

```

```

<400> 215
ggcagcagga aaccaggttg gctgggtttt ggggtgtaaac ttáaaaatga caatcagcat 60
gagctggccg tgggctgtgg ggggtgtagg ggcattcttg taagggaacc ctgcctcagt 120
ccctctctgt tctgggtggg aggacaagga gggccaatag gggccaatag ggaggctgct 180
gctaggangg tttcctaaaa gaacaggtgt agggctaggg ctggttctta gttaggttg 240
ctctgggcag tgatttatat ccacacacct ttctgcaaag tgtcctaagg aganggcagg 300
gataggagtg tc                                     312

```

```

<210> 216
<211> 341
<212> DNA
<213> Homo sapiens

```

```

<220>
<221> misc_feature
<222> (1)...(341)
<223> n=A,T,C or G

```

```

<400> 216
taagcctntc gaanataatg aatgagtcn ggagaggctn atgangaaat nccaaacacc 60
tgactaatng gtgccacatg attncaatgg nctanacatg ggtagatct cntcngnga 120
atgagcaata acacnttaa antcntcaat tgacctagac acttcacact tgaaanata 180
tcacttttna ngaccacgaa tgatgcttaa gaatcacatt ttgtgnngaa ntggantctg 240
gctacttaca cgaacagatt cttattcctg ttcattgagc agtagaccg gaanaagact 300
taagagcttc tganctttct cttagctcca nngcttgaan g                                     341

```

```

<210> 217

```

<211> 273
 <212> DNA
 <213> Homo sapiens

<220>
 <221> misc_feature
 <222> (1)...(273)
 <223> n=A,T,C or G

<400> 217
 nnccttcncc ccttnacnga catgaacaaa acagcngtct ngaaatttta ttaacattnn 60
 aagggttacn ctocctnctt ntgttttccg ntaaanncta nacctgcgcg ggggcggccg 120
 atncagccct atagtggagaa gcctaattnc agcacactgg cggccgttac tanngnatcc 180
 cgactcggta ncaanttttg gngtaaagat ggacatanct ctatccnnga gnactcgtca 240
 nccntttctct atnttacatg cnctaacgna gac 273

<210> 218
 <211> 687
 <212> DNA
 <213> Homo sapiens

<220>
 <221> misc_feature
 <222> (1)...(687)
 <223> n=A,T,C or G

<400> 218
 ttttcagtgc tgttttggtc tcaattttga tgtcaaaatc tctgggttct tctaancnng 60
 ttatgttctt ccancaaattc ctccagttt ttgtaatttt tttctatatc agaagcgcc 120
 gancccaatg cccaattnat acaccgggtc tctccggaac gcttggtcna aagggtntag 180
 tcnattnggc tcttggagc atctnaaatg ctccaggtta ctccangnc cctggannac 240
 ttcanttgct tanacgaatc ctgggtttcg agcgggtcctt gatatcgcaa ggaaatacgg 300
 taaaaattat ccaagctctc tccactna gganttcgga tctcatcagc cgggtaaagg 360
 aaaactctc angaagtgtg ggcttccct cgggtctacc ggctaattgtt aggaattact 420
 tctggctctc ttccgataca tctctcttc aaagtnaaga aggttaaaag aatnttaacn 480
 tctccagtg gctaattggtc aaacaccatc ctcatnagtc agactgggtt ttcgaaagga 540
 ggatataacc tcttgcag ttnnaattaa aagggattaa ccanatggac tanccctcnc 600
 cccgggattt nctctctcac aggagaagg gtctcncnc ttggctcatc cgaagcatag 660
 gcaaaccn gggaattttc agaaacc 687

<210> 219
 <211> 247
 <212> DNA
 <213> Homo sapiens

<220>
 <221> misc_feature
 <222> (1)...(247)
 <223> n=A,T,C or G

<400> 219
 gggcccttcn cctttnaatc gagagatcca aggttcaagg catgaaatac cagnctataa 60
 aatgtctcaa gacntaaata atacggatng ngatagagag gttgaataat aatgaanaa 120
 anatgaaagn nattatgngg gaatacnaaa aaancngact aanggcggca ctgctgggca 180
 tggnaaaatc ggattaattc ctcataggac agccnaaccc cttaaaatct cantttccgt 240
 naccga 247

<210> 220
<211> 937
<212> DNA
<213> Homo sapiens

<220>
<221> misc_feature
<222> (1)...(937)
<223> n=A,T,C or G

<400> 220
cgggctcgag tgcggccgca agcttttttt actatagacc aatattaaag tcagttaagt 60
tccaaataca ganttggaac actaaagtaa aatatttaac gggagaatat ctgcatctga 120
atagtcaac tgtttgctat ttttcagcta tttaatcctt ctacctgtat ctcagaaaca 180
aatttaaaaa ttaatagatt tgacagcaaa atcattcagc actttactta ctccatcagc 240
aaggatatta tgtagtcatt tccatccatg tggccaaact gaaaatccct aaccaccacc 300
aaccaaaaat aaataaataa aaggagaggg ggtgggggga gagagagaga gaaagctcat 360
taaataagtaa aaaagtaaata aaaacaatga agttaaattc aggcctcagt aggccagaa 420
actgtaaaca tttcacatgt aaatcatata caataaacac tgctaaaagt gtaaattcta 480
ctggcttctg agatacaaat acacgagtag aggaaattct aagacatttc tacttggttt 540
atgcataattt aaaattcagg gaaatatcag ctattctacc tgaaatatgt ttaagaaaaa 600
ttcctatttt ctctaaaaaa aggaataatc agaagacgct acatactatg taagaaaact 660
atacaatgac ccatcattag aagattcaga ataggaaaga aataataatt cactaataaa 720
atatatttat attgactgtc tttttttatg atagcaacaa tgattcagca taaagtaaaa 780
atatatgtat ttccgatgcc attttttatt cagttattct tttgagtttc tgttagaata 840
attatctgcc tatctctgac ttctgancag tcatttatgt ccaattataa gtacatgtgc 900
atattttatt accttaaacg cctctcaaat cctttca 937

<210> 221
<211> 353
<212> DNA
<213> Homo sapiens

<220>
<221> misc_feature
<222> (1)...(353)
<223> n=A,T,C or G

<400> 221
ggctatnnna tnntntaan atcntgncnn ccttgacgct gttantaaan aaaaacaaac 60
gaatatacctt tttttgctcc cccctgtncg gataactaat tcacactaat acttacagta 120
taactnttcc tttcaactac caatattaag ttccaagcca cctgggctta agtatcccaa 180
caacttaggt aatttggtgc taaccaccat actatatgct aattataaca ctctaagccc 240
caaggaattt ttgttcagat ttcttatant ttccacttat aaatatnatt ccnctctat 300
gggtatatnn nncctctagn cccatatnnc ccacnggat ttgttgaggg ggc 353

<210> 222
<211> 813
<212> DNA
<213> Homo sapiens

<220>
<221> misc_feature
<222> (1)...(813)

<223> n=A,T,C or G

<400> 222

```

ggcacgaggc tttactaagg ccagactcac tatccccgct tctgttctgt ggtacactgt 60
tcactcctca gtccatccta acctgacttc ctggccactg cagctcttcc gataaggggc 120
agcagtggct tagttattgc taaataataa gcgcacatgc actccctctt tcctgaaaca 180
ttgtccctcc ttggtttctg ttccttcccta ggtctcctat cactcctcct tagtcttctg 240
tgcggacttc tgttccttct gccctttaa agttgggtatt ttccaggatt ctgtcctagg 300
cccacttact tctcattctg cacgttcttg ttggatgatt ctatcacatc cctaacttct 360
gctgcccagt atgcacttaa aattcccaaa tctgtatatc tggatctggc ctgtgtctct 420
agcctagaag tgtgctttat ccagaagca cctcaaacac tgcactttgg aaattaagct 480
tactgagtct cgagtctcaa gtcccaaaact gacttctttt tctctatttt ggtagtgac 540
aacactattt attcagtcac gcaaaccaga gccctgagaa ccatcttaca ttctctttct 600
ccctttactc agttcttgct tctgttcttt ctctctcncc tctcctgcct gtgggcctag 660
ngnccattaa ctgggttgga ctgctttact ttcnattttt ttggctganc taaccnaag 720
ancctnttgt aggggccttt ctntcaggcn tnactctnn caagancccc cgaaaccaga 780
tccnggggan tgctatggnn tggaaatatt ttg 813

```

<210> 223

<211> 882

<212> DNA

<213> Homo sapiens

<220>

<221> misc_feature

<222> (1)...(882)

<223> n=A,T,C or G

<400> 223

```

tcacactact gagaagcagg gaaacccact gaaagggcac gtttcttaac ctgagaatgg 60
ggctactagc ctctaaagca ggaattgcgt tttgtttagt atttccatgg tctgctgcaa 120
ggcgtggcct ttacccaatg gataaatgcg tacaaggctc ttgtgagcag tcaagtttct 180
cgaggtttac agttgaaggg aagtgggatt gtttctctgc gcatttaaatt gaaggtaggt 240
gggtgatcac ctttctttaa atgtgtgaag ggatgagata aagagatagg catcttaatt 300
gccactgatg gccttcagggt gaggacaggc atgagccaac tgaagctttg acaattgtgc 360
tgaacccaaa acttcaaaaa caagaaaaaa catagactgg ctgaaatgat ctaagtcaac 420
agagcatggc cagcgttca tacaaggcag gaccacaggg gaacactgac agcccaggag 480
gcactgagac agaggcagtg ggaagaagtg acagaccca gggactcccc accaacagca 540
gctgctgttg attaggaacc ccagtagac tgtcaggcac ctggtagtgg agaggctacc 600
aaggcccga ctggagagga gccaaaggaa gaaacagtgc agtgcttaga cccctctggg 660
tctgcccgtg tccatacccc tagggagatt ccattccaga agtggacata tccccacaga 720
gtgcctgggg ctactcatc acagctgccc ctncatgaag gcattctcac tgcagcctta 780
ncagggaaca gggtcatttg cattaggcan ctgctgtcc tagaaggcnt cggngtccc 840
tacactgccc atgttcccaa ngnggttcaa nctcnaaaan tn 882

```

<210> 224

<211> 660

<212> DNA

<213> Homo sapiens

<220>

<221> misc_feature

<222> (1)...(660)

<223> n=A,T,C or G

<400> 224

```

gattaaactc aatcattcac ccgggctcga gtgcggccgc aagctttttt tttttttttt 60
tttttttttt ttttggncct ctgggcttgt gcccggaagg ggantgctgg gccacntggg 120
tgtecggtgt tgattttctg ggacctgccc ccccgtnctc cgccccggnt gccgcgtctc 180
actccccgcc gcggtgcnag gggccccgtg tgccgcgcac ccttcacccc gtgttttgct 240
gtttttttga ctntgggctg ccaggggtg cancggcgt ggggccctgg ttgtctttca 300
cctcttcac tgctcactgg ccgnantgn gtcttnttca aacaaacgtn tgaaggncaa 360
nccctgggct cctgtgaacc cggcgtctt tgcggcaaan tctgaggctc cttcgttatt 420
ctggatccgg cctntggctg gangcgtgct ctgcaggcac tgctcccatt gctggcancc 480
ttttctcccc gtggccgcc gcccgcccat naaaggcgtt gcaaacgccc gccctcgcca 540
gcgcaaagtc aaacnccggt ggcccgcgga cccccggcg gncgggaaca cccancagg 600
cgggcaccac aanaagcgcg gncctccggc gtctaaaact nccatgtggc nccccccgn 660

```

<210> 225

<211> 438

<212> DNA

<213> Homo sapiens

<220>

<221> misc_feature

<222> (1)...(438)

<223> n=A,T,C or G

<400> 225

```

aaaaaaaaag gaaaagtacc cagtgtcttc agcttctgag cctcctctac agccctgttg 60
gnttttaaac ctgtgccctg tgtctgtgtc ccacttaat atatatagta cacagctgga 120
gagatggctc agccaggaga gggacccata ggtctgtgaa ttccagagga naggcaggna 180
tttatagggt gntctgtcag gtgaaatcng aggagccaaa gctattgtat gtgcatatgt 240
cagccgggct ctgtgggagg tgggtgaaga cctatggnat gggacangtg tncacgctgg 300
gatctctggc cggttccgaa aagtgaggat caggtagtgg gtggctgatt gcacaagttt 360
anaaccagg attagggaca cacaggtcag cacctgtctc tcagcctcct gactgggtgt 420
gatgggcata ctcaaggc

```

438

<210> 226

<211> 480

<212> DNA

<213> Homo sapiens

<220>

<221> misc_feature

<222> (1)...(480)

<223> n=A,T,C or G

<400> 226

```

aaaattaaaa ccaaaggat cttagaggtc ctttacttca gtggttctca atgtcagagg 60
atgttatgat acctaatcaa aatctccagg ggaactgttt tgaactcaac agactctctc 120
ctgttctgag agactctggc aaagttggga gagctgccag gtactgtcca catgacctg 180
actgcccatt attcaattac cttgaatggc ttatccagtc caataccttc atttcttaca 240
tgaggaaaact gaagcacgta tcacatagt atacaatgaa aacttggcct taatcgattt 300
tcagggtctgc cagtacaatg tcttgagcat atcaatttct tccaaccctt gacaacataa 360
ggtacgacca tcaaattttt tatttctgct aatttattag accaaaaaaa aagggnatct 420
cnccattgt tttacaggga tgattttatt ncagaggatt tcactntggg gctgattcnt 480

```

<210> 227

<211> 423

<212> DNA

<213> Homo sapiens

<220>

<221> misc_feature

<222> (1)...(423)

<223> n=A,T,C or G

<400> 227

```
cattgtgttg ggctctgctt agcacatcac atcggagcac agaggtgacc tgttctgccca 60
cagggatgtt caccttagtc acctgattga ttctcttca ctttggtcac gtgattcctc 120
caggaggatg ttcaccttgg tcgcctgatt cctccaggag gatgttcacc ttggtcgcct 180
gaccacacag gcatctatca ggctttctca ctgcagccac tatgtcccca taatggatga 240
gtgtcttgtg gagagatagt ccaaagtaca ctgatacctt ttgcctcata cggcctcacc 300
ccccaacaat cnaccactaa tgactgcctc atagcagttt ttccatttcc acagtccctt 360
ctatatgtat taattgtcat tctactataa agaanaacttt ttctttttaa aaaaaaaaaa 420
aag 423
```

<210> 228

<211> 249

<212> DNA

<213> Homo sapiens

<400> 228

```
cattgtgttg ggctgtagta aaatatgtgt ctggtaagat atgtgaagaa ataaaataag 60
atcaattaaa tctggcccat tgaatgacac attaattgta tattaatatg taatgttaaa 120
gatattagga gatgggtgga cattatggca aactaaattt gggaggagggt tgaattgtat 180
aatttatgaa atcctaaagt ctagtacatt aacactctct actgtcaact tttcaaagca 240
gtgagaaac 249
```

<210> 229

<211> 436

<212> DNA

<213> Homo sapiens

<400> 229

```
cattgtgttg ggatgttatc tgaccatcac aatatgattt ataatatgga ggcatgaagt 60
catttctcat tggggcagga gtgtggcaag ggggaagaag agctttacca attaactcaa 120
gattatttgg tgacatttct cttacctttt aggtgaggag aaagagacag aggatggaga 180
attggtgctt ttagtatgct gatacattaa gctgcctgga agcagatgct aaatcctatt 240
gaaaataatt ttatttgcgt ttgtcttagg gcattgttta gcaaaatact acacaaaaag 300
tcttgacctg tgtgtttgaa atggcagatg ttcacagtga ggactgagcc ttgggggcaac 360
atcaatcttc acaattctgc acctatttgc tcaataactg gcttggttgg aaaaaaaggg 420
aaaaaaaaaa aaaaag 436
```

<210> 230

<211> 760

<212> DNA

<213> Homo sapiens

<220>

<221> misc_feature

<222> (1)...(760)

<223> n=A,T,C or G

<400> 230

```

cattgtgttg ggnngtggaa ggaaaanttt gaggcaatga agctaaacat aaaagaggaa 60
aagcanatgt tacctcaatg accacaatct acaaagtcca aatanaaaac ctgggagtat 120
gataggatga aactataacc tccagcaaag agcttaacag caattaaaat aaagacaaat 180
ttctgggatg gatnagacaa agtagcatat attacaaagg aaaatanact agtatcatnt 240
acgtttgatt aagtaactgc tttcaaataa ttgaatcata aacaatgatt tctgcggttt 300
taagctcatt attttgggtc cctgggtttct cctaggatgc agtatagaat ctccatgcct 360
gatgtttatg taccaacaga agctgctgct tctttctttc attatttcct ttttaagtga 420
aagttaatac cttttatatg ttacagagaa gaggcagaaa aagccacact cccactatgc 480
tattaaatgc cctgaggatc aactgaggga tgattatacn catggctgaa tacagtntat 540
tcatttgttt ctttggattg tanataacaa aaggtggtat tctgtaacat cttgtgncaa 600
ttanccaaat gttaaggcga aaatggaatc tttcaaacia gtgtntntaa cagggttttga 660
ttttccaaaa tttantatta gaacnttttc aattctggaa gttncccaat ttccangttg 720
tgttttctct tccaattctt ctttcctttg naaattcccc 760

```

<210> 231

<211> 692

<212> DNA

<213> Homo sapiens

<220>

<221> misc_feature

<222> (1)...(692)

<223> n=A,T,C or G

<400> 231

```

cattgtgttg ggggggtgctn tgggggagaac acgcttatgt tganatnggg ctccccgaga 60
aagcctcatt gacacnttcg aataaggacc cntngggaaa ttcangtgag ttgtggacat 120
ncntagataa natcaaaggc cttgangaag tccgcctggc accttcnctg ctgagaggag 180
gttgatacca aatgctaagg ggtccagntg cantgtanta tcgtgagatc agagtgatgg 240
gcaggtgtgg gcatgcgggc cctcaanang aagtgccag gatgactcag acttatgcct 300
atatccattc antcctgttc attattttta ncnttccctc naaggacccc caatttnaac 360
catttgttat tcanggctat acttataaaa gtcattttgt ttnagtctgg gtgatattaa 420
aaccatttgg acgccangca tgggtggctcn nggcctataa tcctntccac cttgggggaag 480
ccgaagctgg ttnaatccct naaggtcngg aatttgaaaa ccacccctgg ncaacattgg 540
gngaaaccct gtctctactn caaaaaacan aaaattttct ggggcctngg ttngcaggtn 600
gcctgaaaat ttccancnt tactccggga aggccgaatg ccntaaaaaa nnnaccttta 660
acccccccga angggcgga agtttccatt tn 692

```

<210> 232

<211> 518

<212> DNA

<213> Homo sapiens

<220>

<221> misc_feature

<222> (1)...(518)

<223> n=A,T,C or G

<400> 232

```

actcaaatgn ccncttgaag gtcaccaga ctcanaangt gtcaagcttt ggggtggggtg 60
gtaatnaata nctcggntc ctgattagtn ctccatagct gatcctggc tgagatnngt 120
tcgagcacc ttcctttgat cccgtcaaac nccnggnaaa agcngcctgc gtatgcncct 180
nagccgaatc tgnnttcccg acaccctccg ctccgtcggc tgccctggtn aagcngctc 240
ctnaaanaa aaagngaagt ctcccngtc tcnccnnt cctngggaaa acngcctgaa 300
ccaatatgnt cccccaaggc cnccccaggg cacntaacc gttaggaggg ccccccctg 360

```

```

gcgttttggc  cnnaagccn  gcccngnaa  taaccccnct  anaaccacgn  aaaaatgcaa  420
agtcccaaag  ggtaaagaat  ctcccnaccc  cccgggtccc  tcgcaanctt  cccctnngna  480
cttgtgttcc  gggaaaaccc  ttancccgan  cctttcca   518

```

<210> 233

<211> 698

<212> DNA

<213> Homo sapiens

<220>

<221> misc_feature

<222> (1)...(698)

<223> n=A,T,C or G

<400> 233

```

gcacgagttt  ctgtctgtct  gtctctctct  ctctctctct  ctctctctgt  ctctctctca  60
cagttagaat  ttggctctgt  tctttattca  atacoccaat  atatgttcat  tagggttata  120
ctgtatacac  tacacataac  agttttgttt  tttgttttgg  atattatttg  ataataagaa  180
ttttaccaca  tcattaaaaa  aagtttcccc  aagctataat  ttttgataat  tgcactcttc  240
cactattcaa  atgtttattt  aactctttct  ctctctggag  aggtttacat  tccattttag  300
ctatgatact  gctttaagag  aaattgtttt  aagataaatt  tccatagaca  ggtcaaagga  360
ggtgaatata  tgtaagcttt  tcgatgcctg  ttactgaatc  tcattctgga  aaacataact  420
gtcaatgccc  tctttttctc  atggtaaaaa  aatacataac  aaaatttacc  atcttaatcg  480
tttttaaatg  ttacagtacg  atagtgttna  ctgtatgtac  cttgtgcaac  agattctctg  540
aaaacttttt  cttttttcaa  aatgaaaact  ctgtactcat  tgaacaggca  gcttcccaac  600
ttccccattc  ctcccanncc  ctacccctgg  ttaanagtct  nacaaaaccc  gggaatttta  660
tgaaatttga  aacactttta  naataccnnc  tattaggg   698

```

<210> 234

<211> 773

<212> DNA

<213> Homo sapiens

<220>

<221> misc_feature

<222> (1)...(773)

<223> n=A,T,C or G

<400> 234

```

ggcacgagcg  cagcttttct  aaagctgtaa  tttgttttgt  atcaaaagtc  ctgcagtata  60
ttagtctcat  tgcattttta  agagtttcca  agtgatcagt  gatggttgct  tgtttttttag  120
tattacggtc  ttatgtaatg  ttcgaaaact  agtcagtttg  gtgctgtcgt  acggggcgga  180
aagatcaggc  caggcaaatg  actctggccg  ccaaagttaa  tgcttaaggc  cgccaacgga  240
ttatgtcctg  ggggttcgat  agggccgtaa  ttaggttgag  ctggtgtang  ctaacctcgc  300
agccatgtcg  gagagagatg  agagacataa  nattttaaag  taggggcgta  ttttacgaag  360
ttctgancca  tttcctttgt  tatcggcccc  ggcaaaagca  actgagataa  atgtgttaaa  420
agactcgatg  attttttcga  cttcagcaac  gtactcagcc  ttgggttctc  gtagtttttc  480
aaaggcagct  atttctgag  attcatgaaa  agtttgactt  ganctgcttg  tcaattttctg  540
cagcncgggc  ttcaactgtt  attgaatttg  tttgattaa  cnaatacgt  tgcnggtcac  600
caaggttttc  catgttttga  ctncacctgg  tcgaaccaat  ttgaattatg  tntttttgcc  660
tgnctgttc  cccnccctt  aaatccatct  cttttttnga  aacctttgng  nggttgaatt  720
cngccgcccc  gttcccaacn  tttggttcna  ccttggaata  aaanatgggt  agt          773

```

<210> 235

<211> 849

<212> DNA
<213> Homo sapiens

<220>
<221> misc_feature
<222> (1)...(849)
<223> n=A,T,C or G

<400> 235
attgggtacg ggccccctc gagcagcctc cactgcaatg ccgctgaatc aagagacttt 60
tcaatacgtt ttatcagtga aaatgatgtg atctgaagag tcctatcttg agcactttgc 120
atgacatcca acgttaatgt ccacaacgtt cttagctgcc caacccttt atcggcaagc 180
tccaaagggtg tgtgcaaacg ttctacggcg tcatgaaaag ctgaaaaatg ctgtgtcaac 240
actgcaccgc tgcgcattct caaaagcagc gcccttatag tctccgcatt cgaagacgat 300
aaccgcgta gaatagcctc ataactcatt ttgtagaaat caatcagagc tgtgctagga 360
acctttccat ccaaaacata cgactgtgcg accacgtctg caaaagcaga cgtcacatta 420
tgcatatgcc ctcttaccgt cagccgatca tcctcactca tagcgacgcg agaaagctct 480
tgttccagct cgtgcacggt atccaattca gtaatcctac gcaacgccgt ctgaatcgtg 540
ttcataagtt cagttttaaa gctcaaaact tcgtctctta ntttaccctt tgtgactttc 600
aaactgggcg antcttcacc attttattaa tcgtcttttt gangganggc ccagcgtag 660
atctgcatcg ccagcggaat cgttactccc tccattcct cctccgggta acgcanntag 720
tttctccgaa gccttaaaat tagccgggga aagggaantt atttgcccca acaangnat 780
cgcgncctg gtggttaaaa ggaactgaaa taaaattaaa nccncttg gggaangcc 840
cgcatactg 849

<210> 236
<211> 310
<212> DNA
<213> Homo sapiens

<220>
<221> misc_feature
<222> (1)...(310)
<223> n=A,T,C or G

<400> 236
ggggtgggtt gcttccgaaa nccggggccc ggccaacttg ttggcttggg aatattcttg 60
caagaaaatt tccagggcgg cgccaatttn atcaagcccg ggcggcctta aaccgaaaac 120
tctggcaggg tcaaccctt tcatggcggn ttgaaagctt gaagcgcccc aagttactcc 180
caagcttggt gcgnttgccg ttggggcgcg gggaaaagt gaaaacacgg gcgntttgtt 240
gcccgcctcg cgggcggtt nttacgccat cctgggaaaa ctttcagggt tggctgctta 300
cnaaacggg 310

<210> 237
<211> 315
<212> DNA
<213> Homo sapiens

<220>
<221> misc_feature
<222> (1)...(315)
<223> n=A,T,C or G

<400> 237
gcacgagtnt ttgttattta natnttgctt tgtttaangg aagaacacaa naatgccctg 60
ctaaagggat tctgtttggt tgcangctgc naggcgggaa aaaatcnaan tgtatnttgc 120

```

acaacangat tttttagaan tcagaactat gacatgaagt canncagggc actctacgac 180
tgaatttgcn gtgctgcett cacangctcc ttntctcgctc tntnctggca ncngtgactc 240
ntacacgtcc tgganantan cctccctana aggaacgact ccgacacccc cccnntaccc 300
ctnaangttc atcng 315

```

<210> 238

<211> 510

<212> DNA

<213> Homo sapiens

<220>

<221> misc_feature

<222> (1)...(510)

<223> n=A,T,C or G

<400> 238

```

ngcacgagtn tttgttattt atatattgct ttgtttaaag gaagaacaca aaaatgcctt 60
gctaaaggga ttctgttttg ttgcaggctg cnngcgggga aaaaatcaaa gtgtattttg 120
cagaaaatga ttttttanaa gtcagaacta tgacatgaag tcaagcaggg cactctagga 180
ctgaatttgc tgtgctgcct tcatatgctc cttgctcgct cttttctggc agctgtgact 240
cncacaggtc atggaganta tcattcccta aaaggaacaa cnccgatatt catctttatc 300
cattaagtnc atctgtccca ttctatgtng tggatgctaa cttttgatca ttgatngtga 360
tnccatggac atntancatc anctttcana ncctnggatc tttgacnagt cttattantn 420
agantccaac tantacgatg ccganttana aatgctggnt ntccaattcc tactcaaata 480
nccnacatga acttccantc cccttgcnaa 510

```

<210> 239

<211> 209

<212> DNA

<213> Homo sapiens

<400> 239

```

ggtgcttttc ccttctactc gtcttctctg ctggcaggag aagctcccgc tactggttgc 60
ccttctacca ctgtcgacac caccaactgc agtgagccag tgtccgaggc tccagccaga 120
aacaggtagc agccatgccg gataccaaac gccacactt aagagcctga aatgacctga 180
cgccacctcc gcatgcttta cctactgag 209

```

<210> 240

<211> 610

<212> DNA

<213> Homo sapiens

<220>

<221> misc_feature

<222> (1)...(610)

<223> n=A,T,C or G

<400> 240

```

ggcacgaggt ttctggctgg agcctcggac actggetcac tgcagttggt ggtgtcgaca 60
gtggtangag ggcaaccagt aacgggagct tctcctgcca ggcaggaaga cgagtagaag 120
ggagcggcat gctggaggct ggagcctgag cccctggggc tcgccttgct gtgtttggtg 180
gtgacgtggg acactgcagc tcggccagag tggtaaaaaa tgccttggtg tacgcttttc 240
tggtctttgcc cgtctatctg ctccaagcca ggctgganga ngagganaag gaatcacctg 300
tggtacgctg gagcctgcat gtggcgtgac tctgcaactc gcctcgtgtg actgatggca 360
gccacggaga ctgcagctcg acagggagtg aggcttctca ntggcttgaa agctcagctg 420

```

```

actcccacga aatttgccgg aaactcaagg ctgtcagtga cnttcgtggc gccaaagactt 480
aancangcgc gttgcatgca tccggccagt gtctgtgcca cgtgccctga cnccaccttg 540
anataancac ccggaacgcg cnnccgcgcag gccgcgcgca cacgnccggg cancaacttg 600
gctggcttcc                                     610

```

```

<210> 241
<211> 474
<212> DNA
<213> Homo sapiens

```

```

<220>
<221> misc_feature
<222> (1)...(474)
<223> n=A,T,C or G

```

```

<400> 241
ggcacgaggt ttctggctgg agcctcggac actggctcac tgcagttggt ggtgtcgaca 60
gtggtangag ggcaaccaat aacgggagct tctcctgccca ggcaggaaga cgantagaan 120
ggancggcat gctggangct ggancctgan cccctggggc tcccttgctg tgtttggtgg 180
tgacgtggga cactgcagct cggccagant ggtaaaaatg tcctggtgta cgcttttctg 240
gctttgcccg tctatctgct ccaagccacg ctggaagang agganaagga ntcacctgtg 300
gtacgccgga gcctgcatgt gggngtgact ctgcaactcg cctcgtgtga ctgatggcac 360
ccacggacac tgccactcta cagngaataa ggcttctccn tggactngaa agctcanctt 420
nactccncc aagtttgncg gaactcaagg ctntcactna acttcgtggc gccca 474

```

```

<210> 242
<211> 415
<212> DNA
<213> Homo sapiens

```

```

<220>
<221> misc_feature
<222> (1)...(415)
<223> n=A,T,C or G

```

```

<400> 242
ngcgggggnt tccaccagct cgtgtgcaca agtngcgcca cacaaacatg cgcaggcact 60
gcatgtcatc natgtgcttc gccgtggttc tggaacagcg agtagaagat ggcgttcggg 120
tcgcgaccaa attcgacgtc ntggatgctc ttgcgcaaga angtcacgta cgggatcggc 180
ccgatggatc cgctnaagcg ccgaaaggcc ctgacttgca aaccgcggct cacagaaccg 240
gcaccaccgg cgccctccgc cnacaaaagt cgagcggcct ccgacacaca ctccctcaca 300
tcccgcgtcnc gcacttcggc ngtttctagc tccgccacgg ttgtcagcgg caccgcgggc 360
gccnagctgc cggcggcatc cgttgcacac agcacacacg gatccgctct cgtgc 415

```

```

<210> 243
<211> 841
<212> DNA
<213> Homo sapiens

```

```

<220>
<221> misc_feature
<222> (1)...(841)
<223> n=A,T,C or G

```

```

<400> 243

```



```

aacgaggtgt cgatgagcgc gaacaatcgc cctccttcat ctctacctga tggatgaactt 60
cgctcctaca gccgagccaa tgaagacgaa ttggtgctgc cgaggatggg agtctcacta 120
gagcacgcgg cgctggacaa ctcatcgact tgtacgcttc cggtagctta gcccattcag 180
ctccactgac gacagagacg gagctggcca ctgccatctc gacgcagcgg gacaaggagc 240
agcttcgggc gccgtatgca tcaactcgaag agaaccagga gcagccggaa gcaggangcg 300
ctgcacggta caggcacttt cggcgcttca gcggatccat cgggcccgat ccgtacgtca 360
ccttcttgcg caagaacatc caggacgtcg aattcggtcg cgaaccgaat gccatcttct 420
actcgctctt ccaggaccgg gcgaagcaca ttgatgacat gcagtgcctt gcgcatgttt 480
gtgcggcgct accttgggtg acacgaacga nggcaaccaa cccgccccag gtgcccgtct 540
atgcattcct gttctgttcc ggtgtgcatg gccggatgtg gaccgtganc ttggtgaatc 600
ggctgggtgca tgaagactta ccgctctcnt caagggcgaa cgcncctcan ttcgganaag 660
gaacaaaacc ccccnnaag aacggcantt gcancntttt ccccgcgtgc cggtcttctt 720
ccattcgggn attctctntc tcnaaaant ccgnaaatc ttctttcggg ttctccccctg 780
tttttatttg cccttcccgc cacttgggtt gttttacatc ctacaancct tttttttctc 840
c

```

```

<210> 244
<211> 761
<212> DNA
<213> Homo sapiens

```

```

<220>
<221> misc_feature
<222> (1)...(761)
<223> n=A,T,C or G

```

```

<400> 244
aacgaggtgt cgatgagcgc gaacaatcgc cctccttcat ctctacctga tggatgaactt 60
cgctcctaca gccgagccaa tgaagacgaa ttggtgctgc cgaggatggg agtctcacta 120
agagcacgcg gcgctggaca actcatcgac ttgtacgctt ccggtagctt agcccattca 180
gctccactga cgacagagac ggagctggcc actgccatct cgacgcagcg ggacaaggag 240
cancttcggg cgccgtatgc atcaactcga gagaaccagg agcagccgga agcaggaggc 300
gtgcacgggt acaggcactt tcggcgcttc agcggatcca tcgggcccgat cccgtacgtc 360
accttcttgc gcaagaaaca tccaggacgt cgaattcggg cgcgaccga atgccatctt 420
ctactcgctc tccaggacc cggcgaagca catttgatga actgcagtgc ctgcccgtgt 480
ttgttgcggc gctacctggt tgcacncgan cganggcaac aaccgcgcc angttgcgcg 540
tctatgcatt cctgtctgt ccggtgttgc atggccggat gtggancgtg ancttgtgaa 600
tccgctgggt gcatgaagga cttaccgctc tcgtcaaggg cgaacgcgcc atcaattccg 660
gaaaagggaac naaaaccccc cccaangac ggnaatttgc ancttttccc ncnctgccc 720
gctcttctcc antnccgggt tctctttctc anaaaattcc c
761

```

```

<210> 245
<211> 710
<212> DNA
<213> Homo sapiens

```

```

<220>
<221> misc_feature
<222> (1)...(710)
<223> n=A,T,C or G

```

```

<400> 245
aacgaggtgt cgatgagcgc gaacaatcgc cctccttcat ctctacctga tggatgaactt 60
cgctcctaca gccgagccaa tgaagacgaa ttggtgctgc ccgaggatgg agtctcacta 120
agagcacgcg gcgctggaca actcatcgac ttgtacgctt ccggtagctt agcccattca 180
gctccactga cgacagagac ggagctggcc actgccatct cgacgcagcg ggacaaggag 240

```

```

cagcttcggg cgccgtatgc atcactcgaa gagaaccagg agcagccgga agcaggaggc 300
gctgcacggg acaggcactt tcggcgcttc agcggatcca tcggggccgat cccgtacgtc 360
accttcttgc gcaagaacat ccaggacgtc aaatttcggc gcgaccgaat gccatcttct 420
actcgctctt ccaggaaccg gcgaagcaca ttgataacat catgcctgcc catgtttgtt 480
ggggccctcc tggttgcnca cgaancgaag ggcaacaaac ccgcgccagg tngccgctct 540
tatgcattcc ttgtctgttc cggtnntgca tggcccggan nttggaaccg tnancttggg 600
nnaatcggct ggtgcattga aggaacttac cgctctcgtc aagggccgaa cgcnccttcc 660
agttcggana aaggancgaa aacccccccn naaggaacgg cnttgcnnng 710

```

```

<210> 246
<211> 704
<212> DNA
<213> Homo sapiens

```

```

<220>
<221> misc_feature
<222> (1)...(704)
<223> n=A,T,C or G

```

```

<400> 246
aacgaggtgt cgatgagcgc gaacaatcgc cctccttcat ctctacctga tgggtgaactt 60
cgctcctaca gccgagccaa tgaanacgaa ntggctgctg ccgaggatgg gagtctcact 120
aaagcacgcg gcgctggaca actcatcgac ttgtacgctt ccggtagctt agcccatcca 180
gctccactga cgacaganac ggagctggcc actgccatct cgacgcagcg ggacaaggga 240
gcagcttcgg gcgccgtatg catcactcga agagaacagg agcagccgga agcaggaggc 300
gctgcccggg acaggcactt tcggcgcttc ancggatcca tcggggccgat cccgtacgtc 360
accttcttgc gcaanaacat ccaggacgtc gaatttcggc gcgaccgaa ttgccatctt 420
ctactcgctc ttccagggac cggcgaagca cattgatnaa attgcattgc ctgcgcattg 480
ttgtgcgggg ctccctggtg ccccgancga agggcnacaa ccccgcgcca ggggtgccnct 540
ctatgcattc ctntctgttc cgggtgttgc tgggcgggat ttgaaccgtg aanccttggg 600
aatccgnttg gtgcattaag aacntaaccg ttctctgtca ggggcnnacc ggncccttnc 660
aatttcggaa aaangaacca aaancccccc cnccaagga aacn 704

```

```

<210> 247
<211> 618
<212> DNA
<213> Homo sapiens

```

```

<220>
<221> misc_feature
<222> (1)...(618)
<223> n=A,T,C or G

```

```

<400> 247
ggccgccagt gtgatggata tcgaattcaa cgaggtgtcg atgagcgcg acaatcgccc 60
tccttcatct ctacctgatg gtgaacttcg ctctacagc cgagccaatg aagacgaagt 120
ggctgctgcc gaggatggga gtctcactag agcacgcggc gctggacaac tcatcgactt 180
gtacgcttcc ggtagcttag ccattcagc tccactgacg acagagacgg agctggccac 240
tgccatctcg acgcagcggg acaaggagca gcttcgggcy ccgtatgcat cactcgaaga 300
gaaccaggaa gcagccggaa gcaggaggcg ctgcacggta caggcacttt cggcgcttca 360
gaggatccat cgggcggatc ccgtacgtca ccttcttgcg caagaacatc caggacgtcg 420
aattcggtcg cgaccgcaat gccatcttct actcgctctt ccaggaccgg gcgaaagcac 480
attgatgaca tgcagtgcct gcgcattgtt gtngcggcgc tacctgggtc acacgagcga 540
nggcaacaaa cccgcgcccc ggtgccgctc tatgcattcc tgttctgtcc ggggtgtgcat 600
ggcccgatg tgaacccc

```

<210> 248
<211> 622
<212> DNA
<213> Homo sapiens

<220>
<221> misc_feature
<222> (1)...(622)
<223> n=A,T,C or G

<400> 248
gcacgagagc ggatccgtgt gtgctgtgtg caacgggatgc cgccggcagc ttggcgcccg 60
cggtgccgct gacaaccgtg gcggagctag aaactgccga agtgcgcgac ggggatgtga 120
gggagtgtgt gtcggaggcc gctcgacttt tgttggcgga gggcgccggt ggtgccggtt 180
ctgtgagccg cggtttgcaa gtcagggcct ttcggcgctt cagcggatcc atcgggccga 240
tcccgtacgt gaccttcttg cgcaagagca tccacnacgt cgaatttggt cgcgaaccga 300
acgccatctt ctactcgctc ttccagaacc cggcgaagca cattgacaac atgcnntgcc 360
tgcgcatgtt tgtgcggcgc tncctgntgc acacgaccga gggtagcaac ccgcgccagg 420
ntgccnctct acgcattcct gtctgcccgg tgtgcgtggc cnggatgtgg accntgagcn 480
gngantccg ctggtgcntg aagacnttgc cgctctcgctc aaggccnacc gccntcgcg 540
gcggaaaaag gancaaaanc cccccgcaa gaaccggcnc tgcaccgttn tcgcgcccct 600
gctgggctct tctccttac gg 622

<210> 249
<211> 517
<212> DNA
<213> Homo sapiens

<220>
<221> misc_feature
<222> (1)...(517)
<223> n=A,T,C or G

<400> 249
cattcgagct cggtagccgg gatccgattg gtaaagggga tgcggaacag ccagctggtg 60
ttttcgggtg gcccggggca gcccacatcg ctgtggtcgt tggcgtagtg gatgcgatgt 120
gccgggacaa acgcgttttc caccacgatg tcatgactgc ctgtgccgag caggcccagc 180
acatcccagt tgctctcaat gcggtagtcc gccttgggca ccagaaaagt cacatgctcc 240
aggccaggcg tgccatcacg cttgggcagc agaccgcta gaaacagcca gtcgcaatgc 300
ttggagccgg tggaaaagct ccagcgaccg ttgaacctga atccgccttc caggggctcg 360
gccttgccag taggcatata ggtagaggcg atgcgcacgc cgttatcctt gccccacaca 420
tcctgctggg cctggctcgg gaaaaancgc cagctgccaa ggggtgaacg ccgaccaccc 480
cgtaaatcca ggccgtggac atgcagccct ttaccaa 517

<210> 250
<211> 215
<212> DNA
<213> Homo sapiens

<220>
<221> misc_feature
<222> (1)...(215)
<223> n=A,T,C or G

<400> 250
nntncattgg gccgacgtcg catgctcccg gccgccatgg ccgcgggatt accgcttgtg 60
accgcttgtg accgcttgtg accgcttgtg accgcttgtg accgcttgtg accgcttgtg 120
accgcttgtg accgcttgtg accgcttgtg accgcttgtg accgcttgtg accgcttgtg 180
accgcttgtg acnggggggtg tctggggggac tatga 215

<210> 251
<211> 231
<212> DNA
<213> Homo sapiens

<220>
<221> misc_feature
<222> (1)...(231)
<223> n=A,T,C or G

<400> 251
ngcgccacc tngtgattga tggctcgttta ctatcaagta tgtacatctt gctctagaca 60
actccnattc agtgggaagaa attgggaaag tatcccgat aagtaatagg nattaggtct 120
nccttantgc ttggtgggat attccncaac tgntccngat cggatcagnc tegtgtcngn 180
gaatgtgctc gatcgttatt ctactnctga gcttctatcc nnacgtggcc t 231

<210> 252
<211> 389
<212> DNA
<213> Homo sapiens

<220>
<221> misc_feature
<222> (1)...(389)
<223> n=A,T,C or G

<400> 252
atgtatcanc nctgttggtg ttncatcttt tgcagtcngt tctaagggn gataantatc 60
agagatgcta atgcatnttc tgccaggcca ncattgggtg cctatgcgta ctcttcttat 120
cttcctgaag agtcatctct ggnggatgtg tccccccctc tccacagtgt ttgcaagcgt 180
taccacgcn tgtcggngcc gggaaggtcn ncacatccgg gnagacttcc ccncgtntga 240
atcgtntctn gaatctccgg cgtctccct naacctcttg actnggacaa ngncctgtnt 300
tccctntgt gaactngtan ccgccccctc tccccccctc agcctaancg ggaangaaga 360
cngggtcnat ctngggcncc acaagaant 389

<210> 253
<211> 289
<212> DNA
<213> Homo sapiens

<220>
<221> misc_feature
<222> (1)...(289)
<223> n=A,T,C or G

<400> 253
nggggcenna tgagcgcgcg taatacnatc actatngggc gaattgggta cgggcccccc 60
tcnagcggcc gccttttntt nttttttnt tntttttnt caaaacaccc tccncntgg 120
atgganacgt nacctttctc taaccanac ttcacaatnc nantctcagg cagccgcctc 180

aaanccgatg tcangttggn atntcaantn caatcttatt ttngngaatta anctganatt 240
gtggatggtn naccaatcan atacttggn tccgttgaac ccctgtgga 289

<210> 254
<211> 410
<212> DNA
<213> Homo sapiens

<220>
<221> misc_feature
<222> (1)...(410)
<223> n=A,T,C or G

<400> 254
attgtgttgga gaactttagt acagctatat caattgcagt gctatttctc tgagggtattg 60
aatctcantt attataattt tgaaatccaa ttggcttgga cttcattatt ttccaactaa 120
aaagatgatt gaaggattta ttgaaatgt gtaaagagta atatagattt tatgcttatg 180
tttccttgaa aaaagtaggt aaaattcttc tggaagtgtt actcctaaaa tacaatgaa 240
catgtcaaga attacataaa ttctttaaac tatccttaan aannaatggc tctatgtann 300
gagngaccct tacagactat taagaattaa cttgcatggc anagactcat ttanattcat 360
gaaatggntc tcactttctt ggtaagatct ggcttggaac tttttggtaa 410

<210> 255
<211> 668
<212> DNA
<213> Homo sapiens

<220>
<221> misc_feature
<222> (1)...(668)
<223> n=A,T,C or G

<400> 255
tttttttttt ttttctgtg ccaggcacta taccactgtg ctaggtgcct tctttgcatt 60
acttcatttc ctcataagct ttctgaggan acagaaagct tgagggtcac gtagctagca 120
tctacataaa ttagttgcta aaaacataca atacgtcttc cggcaggctg tcattagtaa 180
ctgatactac tagttgataa tctcataaac ctagcanaan ctaccattta agctgaaaca 240
actgtcaata tctaanta aaacttaaat ccataaatca actatattct aaaatctgac 300
ttcagttcaa ttaaaaaatc actagttgtt acctacctcc ttctgaaagc cagtacaagt 360
taaatagaaca actcccaggt ttaacaaaca agtggcatct aaaaaaaga tttaaaaaat 420
aatccactta catatattta aaatggcatt aataaaacaa aatttatcca ataacnaant 480
ggcaaaggaa ggtgtccaat tattacatgt tataaatctt taaattaaac ttttcttngg 540
tttttctntcc ctanaataaa tacaancctt tccccgccna accagaaaaa agcaaaaaac 600
aaaacccaaa aactcccagc ncngcttaaa aaacncaaaa aaaataaaan ctctattaaa 660
tgcccnaa 668

<210> 256
<211> 487
<212> DNA
<213> Homo sapiens

<220>
<221> misc_feature
<222> (1)...(487)
<223> n=A,T,C or G

```

<400> 256
cgnaaccgtn cnttttttnat gtgcgcccgc cncagnacca gngccgctac aggcgaaggc 60
cggaagcacg ggagaggntt nggaaaaaaa agagtgccta caaagagcat attcgagag 120
ttgggatgag tgaaggggac cagaaggngc agcggtaggg acgctgaaa ggangcngcg 180
gagaaatgac agcaagaagg gganaagcac acgaaaaggc agtatcctcc tcccccttt 240
tcgaggactg ccgcatcttt gttttctgcc cattccagtc accgaanaag atcccaana 300
aagaagaaaa gaancagagg tgcacttcgc ttcataattc nctcgctttc ttttctgnct 360
tcacnagttc tgcaggattg cccttgtcct ctcccgagca catctacgca cgnatgaggc 420
tcggcaggtc aagccnacaa aacnctcgca ctctctttt tctttgcngg tctgngtggt 480
angngg 487

```

```

<210> 257
<211> 502
<212> DNA
<213> Homo sapiens

```

```

<220>
<221> misc_feature
<222> (1)...(502)
<223> n=A,T,C or G

```

```

<400> 257
cctttgaaag nccngctnaa ttengnganc cccngatca gcaccaggga gctacaacna 60
aggccggaag caggggattt ngccggaaaa aaaagagtgc ttacaaagag nttatccna 120
nagatgggat gagtgaaggg gacgagaagg tgcagcggta gggacgcgtg aaaggaggca 180
gcgagaaaat gacagcaaga aggggagaag cacacgaaaa ggcagtatcc tctcccccc 240
ttttcgagga ctgccgcac tttgttttct gccattcca gtcaccgaaa aagatcccaa 300
agaaagaaga aaagaaacag aggtgcactt cgcttcatat ttcgctcgct ttcttttctg 360
tcttcacaag tctgcaggat tgcccttgct ctcttcgag cacatctacg cacgtatgag 420
gctcggaggc caagccaaaa aaacgcttgc actcctcttt ttctttgcgt gtctgtgtgt 480
atgtggaatt ccgcggncc gc 502

```

```

<210> 258
<211> 510
<212> DNA
<213> Homo sapiens

```

```

<220>
<221> misc_feature
<222> (1)...(510)
<223> n=A,T,C or G

```

```

<400> 258
actcgnact cgatncanta caagagnnta tgnattcgaa ngtgccccg catcagcacc 60
agggagctac aacgaaggcc ggaagcaggg gagagggccg gaaaaaaaag agtgcttaca 120
aagagcatat ccgcagagtt gggatgagtg aaggggacga gaaggtgcag cggtagggac 180
gcgtgaaagg aggcagcggg gaaatgacag caagaagggg agaagcacac gaaaaggcag 240
tatctctctc ccccttttc gaggactgcc gcattcttgt tttctgcca ttccagtcac 300
cgaaaaagat cccaaagaaa gaanaaaaga aacagaggtg cacttcgctt catatttcgc 360
tcgctttctt ttctgtcttc caagtctgca ggattgccct tgcctcttc cgagcacatc 420
tacgcacgta tgaagctcgg aggtcnngnc aaaaaaacgc ttgcactcct ctttttcttt 480
gcnagtctgt gtgcatngg gaaatnctna 510

```

```

<210> 259

```

<211> 292
 <212> DNA
 <213> Homo sapiens

<220>
 <221> misc_feature
 <222> (1)...(292)
 <223> n=A,T,C or G

<400> 259
 gannngagtc acgaaaaggc agtatcctcc tcccccttt tcgaggactg ccgcattcttt 60
 gttttctgcc cattccagtc accgaaaaag atcccaaaga aagaagaaaa gaaacagagg 120
 tgcacttcgc ttcatatttc gctcgttttc ttttctgtct tcacaagtct gcaggattgc 180
 ccttgtcttc ttccgagcac atctacgcac gtatgaggct cggagggtcaa gccaaaaaaa 240
 cgcttgcaact cctctttttc tttgcgtgtc tgtgtgtatg tggaattcct tg 292

<210> 260
 <211> 582
 <212> DNA
 <213> Homo sapiens

<220>
 <221> misc_feature
 <222> (1)...(582)
 <223> n=A,T,C or G

<400> 260
 gcacgagggt ggggtggtact gtgtataata actccagatc cttgaccaag tttggagagt 60
 cacttatggc catttgaaac caaatgaagg atcaaaggac taattatttt gaatacctct 120
 gagtgttttc cccaagcttg agaagagttt cattcagcta taaaatgctc attgtgcaaa 180
 tgagtggttt ccatgctgta taattaaagc attgccttta ataataatttt attaccttta 240
 gcttgtcttt ttaatttgag gaaaatccaa acaattttaa gtaaaacgtg ataaagacag 300
 tttttcngga gananaaggg nagatcgcta tgtttattcc acttaatatc tatatcaaatt 360
 atttgtatca aaagcagact ctcaacttta aatatattct ctaatggcna gaatcttttn 420
 cctagattga gagtcagagc tcacatagna tnactgctgg taaatagaca cttagactat 480
 agagctnagc tnaagttcca actanccaac tgcatttctg aatatgcttt ttattnaaag 540
 gccagnnctt ttgccttttt nccnccctaa tnccttctat tg 582

<210> 261
 <211> 783
 <212> DNA
 <213> Homo sapiens

<220>
 <221> misc_feature
 <222> (1)...(783)
 <223> n=A,T,C or G

<400> 261
 gcacgaggca aaatacagag ggtatttttac catggacagg caaccatttt ttccaggaca 60
 actctttgca gcagagagct attctctttc ttttgcctta cactctcaac ctcaactctc 120
 gagtgtctgc atcctanttt tccatggcca taagataagg aaccatgagt gttactctag 180
 atgaggctgt ttcattgtgg gagctcatcc aggatccaag gtagattcat cagaagggta 240
 agtataggag tgggaaccca aatctctact tttattttga ggccttctct cctcaatttt 300
 aaattgtaaa atcaaactta aaactgggta tctgatggcc agttaaaaga ctgggtatct 360
 gattgccagt taagagatgg tcattttatgc tcaccaccat tctcaagacg cagggtgagg 420
 gacangcttg ctgggggaatg ctgancgaat cccccaatgc cttcaggatt ctgggaatgg 480

```

tggctctgnt ttaaactggn tgactttttac aaagagccta cccgtcatgg ggggactggg 540
aagaaaaccc anangcagnt tctggcccan gggtacaccc ccanggn tac cttgaaggnt 600
ttttggacat acctnttnc cccctnttac tgnttcatta gggcntcnnc aaccaantt 660
tccaagttnt ggcccttcna aaantttttt nttttcentt tccanggacc cccctggntt 720
cctggnnccc cctttttata nccaaccttg ccnggnattt tttcnenttn aaagggaaat 780
aat 783

```

```

<210> 262
<211> 741
<212> DNA
<213> Homo sapiens

```

```

<220>
<221> misc_feature
<222> (1)...(741)
<223> n=A,T,C or G

```

```

<400> 262
tgaaccctan tgggcccggc cccctcgagt cgacgggtatc gataagcttg atatcgaatt 60
cggcacgagt gtatatcttg ttattatacc ccagattnaa gtgtatattc ttaggcagta 120
gttctgggta acatccttac tacataaaat ccacttacta ttttaagtatt attctaacag 180
gaggtagaat agctgcctta aaaaatgtag tgatcgaatg gcagtttttc tgctgaatgg 240
aaattactga cacaaaattt ggttttggga gacattttcc tccttggtgt tgagttttcc 300
cattcacgga tagggcataa agcttggttt atagttgagg ggtgcaaaag ggggaatagga 360
ttgggaaaat acagtgttcc agcaaaggtc tgacaaggta catcttgagg aggattccta 420
ttctgctang tggcactgta ngtcttgaaa tactgtgtac tttccagaca aaggatagag 480
aaaaagacct tcactgggtg ggggagaaga aaacccttgt tcctagaaaa atcacaaaaa 540
aggcatcctt tancctatat tcccagnttt actggnecat ttgcttgatg tgactgacnc 600
ngattatttc ctttnactgg naaaaattcc tgccnctttg gatatnaang ggggnaccng 660
gaaaatnggg ggcnttgggg aaggaaanaa aaaaaattgg agggaccnaa ctttggaaaa 720
tgggntgctt nangccttaa g 741

```

```

<210> 263
<211> 437
<212> DNA
<213> Homo sapiens

```

```

<220>
<221> misc_feature
<222> (1)...(437)
<223> n=A,T,C or G

```

```

<400> 263
ggcacgagag aatgtgttca cagacactat tttatannta tctgatgtgt actgtgtctg 60
gtggatgtga aagccatact tcttaaactc gatttgaaaa gcaaactctga ttatcacagc 120
cataattaaa tttggccagc cttecttcc cctccctcc ttcacttcc tccttccctc 180
cgctcgtgc cgaattcggc acgagcctga cctcactacc aaaaaaaaaa aaattcaaag 240
tgcttgaggt ttccaggcat tcttagctct atttacttac tcccacctc aaatggcctt 300
agaattcaaa ttctgnanaa aatggattgc catanataat ccaatgaaaa tgggtcatat 360
tttgccatta atagaatcac agtcnacaag ggactaatag aattagtcac ttangtatcn 420
ttagatttgg gagacnn 437

```

```

<210> 264
<211> 706
<212> DNA

```


<213> Homo sapiens

<220>

<221> misc_feature

<222> (1)...(706)

<223> n=A,T,C or G

<400> 264

```
gcacgagcac cccaagggtt taggacaaaa tgggatgagt gaattcatgg cttgacagac 60
tgaacagaaa aatgagggtc cgtgctccat attcatgtgc atctgcccct catggtgaca 120
tgctaattgg ttggccggtg cacaagacaa ggaagtgcag gtttcctgtt gctcacacag 180
tgcttcctgt ctgctgtggc aggagccggg aggaaggag cgagccaaga ggggtgctgc 240
ccaccggaac cgatggcgcg aggcgcgaga gctaaatggg ggccctctcca gggagtgtgc 300
tgttcacggc tccatcgctg ttagtaagta tcttgtgatt tcggaattta aatgagggtg 360
tgtttaacct gcataacatc tggcttttaa aatctgactt tattttcctt ttatttctgt 420
gcatcggtc aggcacactt agtgggtggc taggtgttga agtcagggtta ccaaacagca 480
cgccctctct ttattctcag gctgcgtgtt tcattgattc tgaaggtcag atggctgtgt 540
tcaagttctg ttagtatatt ggtgtcagaa atgaaaagat gatgtaacct ttataactt 600
cttaaaggct catatcatgt caggaaatta acctgtacga gttatggaca aatgcccatac 660
ctgatgattt tcanccatga aaatgaatna aagggganaa gggcca 706
```

<210> 265

<211> 717

<212> DNA

<213> Homo sapiens

<400> 265

```
ggcagagca gcattacggt ttatacacat gtccacaact cagcattgct ttcaaaatag 60
gaacacttta ttagtaaaga ggaagaaatt gcctaacacag actcagtgtc tttcccataa 120
caatcatctg ccaagccgca ggcctaacca ggaaatccca tttccttttg gcgttggtgc 180
ctccaccaac agatacaacc ctgatgccaa atgttgtatg gtttgtaggt gttgtgagcc 240
aatgagggca tgcctagggc caaaggctgc cctttggaat gagggcaagg tcgtagactc 300
catcaaacia caaatgcac ctcctccaaa atcaaatgct caacacatgc agcctttcgt 360
atgcccatct cccctttact cattttcatg gctgaaaatc atcaggatgg gcatttgtcc 420
ataactccta caggttaatt tcctgacatg atatgagcct ttaagaagtt ataaagggtt 480
acatcatctt ttcatttctg acaccaatat actaacagaa cttgaacaca gccatctgac 540
cttcagaatc aatgaaacac gcagcctgag aataaagaga gggcgtgctg tttggtaacc 600
tgacttcaac acctaaagca ccactaagtg tgccctgagcc gatgcacaga aataaaagga 660
aaataaagtc agattttaaa aagccagatg ttatgcaggg taaacacaac ctcatta 717
```

<210> 266

<211> 362

<212> DNA

<213> Homo sapiens

<220>

<221> misc_feature

<222> (1)...(362)

<223> n=A,T,C or G

<400> 266

```
ggcagaggt tagatttaac ttccacagat gactcagcag aggataacta ctaatcagag 60
tacaacatca aaactgtaac cagtataatc actggattat gagcaactca aaatagctcc 120
agttttccaaa gggccataaa ctgcacatat cagtactatg tgcaattaac acataattta 180
ttatgaaaat gtggacatgc caggtaagta aggggattta ggttgacttt ttataatact 240
ttaaatttga aatgccattt ctgtggattg gatgacatct tccagggtgt ntaatnctgg 300
```

gntacctnct gatanatcct gananaaaga ggtancacca gcgtctatca nacctcaata 360
ca 362

<210> 267
<211> 692
<212> DNA
<213> Homo sapiens

<220>
<221> misc_feature
<222> (1)...(692)
<223> n=A,T,C or G

<400> 267
ggcacgaggt tagattttaac ttccacagat gactcagcag aggataacta ctaatcagag 60
tacaacatca aaactgtaac cagtataatc actggattat gagcaactca aaatagctcc 120
agtttccaaa gggccataac tggccctttt aanacttttn gcaattaaca cataatttat 180
tatgaaaatg tggacatgcc aggtaagtaa ggggatttag gttgactttt tataataactt 240
taaatttgaa atgccatttc tgtggattgg atgacatctt ccagggtgctt taatttggtt 300
tacctcctga tagatcctga cagaaagagg nagcaccagc gtctatcaaa cctcaatata 360
gngtgtgaaa cacangagag cctgcttttg tcnacacggg gaaacacatt gttatcacia 420
cacacaaaag gcaanctncc aatgggggnan ncttacctgn cctctcatat tgggggcaan 480
gaaaangggg ccccanatg gctgagtana tccccaaaaa ccnccactan tggtcagnnt 540
gcttcccan acagccagat gactgaattt agcccaagct gcagtctcaa aaccagcttt 600
ctgacaatca gtaacaagaa catactggtc tgttgacagt agctcaagtg ttgggtgttc 660
agtcaaaanc catggatgcc aatcatctcc ca 692

<210> 268
<211> 605
<212> DNA
<213> Homo sapiens

<220>
<221> misc_feature
<222> (1)...(605)
<223> n=A,T,C or G

<400> 268
cgtgccgaat tcggcacgag ngcacatatc agtactatgt gcaattaaca cataatttat 60
tatgaaaatg tggacatgcc aggtaagtaa ggggatttan gttgactttt tataataactt 120
taaatttgaa atgccatttc tgtggattgg atgacatctt ccagggtgctt taatttggtt 180
tacctcctga tagatcctga cagaaagagg tagcaccagc gtctatcaaa cctcaatata 240
gttgtaaaac acagagagcc tgcttgccca cacatggaga aacattgtta tcacaagaca 300
cagaaggcaa acttccaatc tggcataact ncctgtcctc tcatatttgg ggcaatgaga 360
atggtggacc agatggcttg antagatgcc aaagaacacc canactgggc agcatgcttn 420
cccagacagc cngaagactg aaatttantc ccagctgcag ncttaaacc tttttttgac 480
nttccgtaac cagaccatac ttttttttct gatgcttttc ttaacttcat cttttccaat 540
taaattcatt agtnnaacc taaanggggc ccgttttccg aaaaattttc nttntnttt 600
cccn 605

<210> 269
<211> 535
<212> DNA
<213> Homo sapiens

<220>
<221> misc_feature
<222> (1)...(535)
<223> n=A,T,C or G

<400> 269
gcacgagng caaccccggt gtgggtcttc tgggatgaac ctggagacct gagcttgac 60
agcttccttg gtaaattgag gaggcattga ccacaagatt gccaaagctcc tttctatcca 120
aacttgatat tgtagatttc catgatccag ttcatacagg ttgatggctg aatctcatgc 180
actanaaaaa ggtaatatata aaganaaaaa tanaangatn ttcaagttag tataaanacc 240
tttaattctca ntctttctag ttcaaagaga cggaacaatg agagatgctg gttcatanag 300
ctgntanatt taacttccac agatgactca ncagaggata actactaatc anagtacaac 360
atcaaaactg taaccagtat aatcactgga ttatgagcaa ctcaaaatag ctccagtttc 420
caaagggcca taaactgcca tatcaantac tatgtgccat taaccataa tttattatga 480
aatgtggac atgccangtn agtaagggga tttagggtga ctttttatna tactt 535

<210> 270
<211> 803
<212> DNA
<213> Homo sapiens

<220>
<221> misc_feature
<222> (1)...(803)
<223> n=A,T,C or G

<400> 270
gcacgagggc aaccccgagg tgggtctctt gggatgaacc tggagacctg agcttgacac 60
gcttccttgg taaattgagg aggcattgac cacaagattg ccaagctcct ttctatccaa 120
acttgatatt gtttagattcc atgatccagt tcatcacggg tgatggctga atctcatgca 180
ctagaaaaag gtaatatataa agaaaaaaat aaaaagatat tcaagttagt ataaagacct 240
ttaatctcag tctttctagt tcaaagagac ggaacaatga gagatgctgg ttcataagac 300
tgtagatttt aacttccaca gatgactcag cagaggataa ctactaatca gagtacaaca 360
tcaaaactgt aaccagtata atcactggat tatgagcaac tcaaaatagc tccagtttcc 420
aaagggccat aaactgcaca tatcagtact atgtgcaatt aacacataat ttattatgaa 480
aatgtggaca tgccaggtaa gtaaggggat ttaggttgac tttttataat actttaaatt 540
tgaaatgcca tttctgtgga ttggatgaca tcttccaggg gctttaattt gggttacctc 600
ctgatagatc ctgacagaaa gaggttagcac cagcgtctat caaacctcaa tacagttgta 660
aaacacagag agcctgnttt gcctacncat ggagaacatt gttatcacia gacacagaag 720
ggaacttcca tctggctact tacctggctt tatttttggg gcaatganaa tnggggggacc 780
aatgntgan tanatgcaa aaa 803

<210> 271
<211> 836
<212> DNA
<213> Homo sapiens

<220>
<221> misc_feature
<222> (1)...(836)
<223> n=A,T,C or G

<400> 271
gcacgagggc aaccccgagg tgggtctctt gggatgaacc tggagacctg agcttgacac 60
gcttccttgg taaattgagg aggcattgac cacaagattg ccaagctcct ttctatccaa 120
acttgatatt gtttagattcc atgatccagt tcatcacggg tgatggctga atctcatgca 180

```

ctagaaaaag gtaatatataa agaaaaaaat aaaaagatat tcaagtgagt ataaagacct 240
ttaatctcag tctttctagt tcaaagagac ggaacaatga gagatgctgg ttcatagagc 300
tggttagattt aacttccaca gatgactcag cagaggataa ctactaatca gagtacaaca 360
tcaaaactgt aaccagtata atcactggat tatgagcaac tcaaaatagc tccagtttcc 420
aaagggccat aaactgcaca tatcagtact atgtgcaatt aacacataat ttattatgaa 480
aatgtggaca tgccaggtaa gtaaggggat ttaggttgac tttttataat actttaaatt 540
tgaaatgcca tttctgtgga ttggatgaca tcttccaggt gctttaattt ggtttacctc 600
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aaacacagag agcctgcttt gnctacacat ggagaaacat tgtatcacia gacacagnaa 720
ggcaacttcc atctgggata ctacctgtct ctctatttgg ggcatganat ggggacaatg 780
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acctcnccca aatncncct naa 203

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<210> 273
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gtggttatct ctctctgggt gtctttctgt ataaanttct tgcctgact ncctanctcn 180
ctccccctg gtccttcctt tagngtaaca nctggtaatc cctntcttct ttgctctcct 240
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ggaagggagn gtccaanttc tctgttccan aggctnagcc tagaganaat gatgggagan 420
ggtttactga gatcatngnn tcttctcgaa gatatnnttt aggggtgtcc ccataagng 480
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<210> 274
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 ccctgagatg cctggactnn cctcaccgga gatcctagac ggtgntancc cctgagagtc 180
 tctctcttcc tgctctccta acttctccta atgatccctc cnattgtcta ctgtccnatt 240
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 taccttccgc tcatatgctc tgtangctac accctctgtg actgctttct cagttacgtg 480
 caacaaggtn ttcatatctn gaactcttac accattctag anggatcncc cctcgganaa 540
 antttggaan aacaagcaag ancanaatnc ctctctngtg ntacacnanc cggttncgt 600
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 <212> DNA
 <213> Homo sapiens

<220>
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 <222> (1)...(392)
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 tgtctgggcc ctncnaatc cctnnaatat ctctacacc tgtagtanna atnaactacn 300
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nccttnttna ctgtgccttn attttttcgc ct 212

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<210> 279
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ctaaggangt gngctaactt anantgatna ctttgctcat actgcctgc cctnaatgcc 180
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 ttgctcatat tgcctgtctc tnaatgccta ngcttgctc accctgntgc cttacnnnat 180
 cgaacaccta cgcgggtctat aggtctcttg ctctatcagg actnctcttc nagcttcntc 240
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 <212> DNA
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ctctctctcc ntat 194
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<212> DNA

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<400> 286

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<210> 287

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gtacggcatc attacganat ggncatcttc gtttaccttt ntcgctggac acaagcgtc 119
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<211> 170
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<212> DNA
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<223> n=A,T,C or G

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aattcggtt accntggctg cggncnaagt acttaactca atccatctnt cactcaggat 120
naatgc 126

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<223> n=A,T,C or G

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naatgc 126

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(21) International Application Number: PCT/US00/32520

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(54) Title: COMPOSITIONS AND METHODS FOR THERAPY AND DIAGNOSIS OF BREAST CANCER

(57) Abstract: Compositions and methods for the therapy and diagnosis of cancer, such as breast cancer, are disclosed. Composi-
tions may comprise one or more breast tumor proteins, immunogenic portions thereof, or polynucleotides that encode such portions.
Alternatively, a therapeutic composition may comprise an antigen presenting cell that expresses a breast tumor protein, or a T cell
that is specific for cells expressing such a protein. Such compositions may be used, for example, for the prevention and treatment of
diseases such as breast cancer. Diagnostic methods based on detecting a breast tumor protein, or mRNA encoding such a protein, in
a sample are also provided.

INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 00/32520

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 C07K14/47 C07K16/30 A61K38/00 A61K39/39 A61K45/00
 G01N33/53 G01N33/531 G01N33/574

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 C07K A61K G01N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ, BIOSIS, EMBASE

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category * | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|------------|--|-----------------------|
| X | WO 99 33869 A (CORIXA CORP) 8 July 1999 (1999-07-08) Example 2 in connection with pages 15 to 17 | 35,36 |
| Y | Example 1 | 1-34, 37-59 |
| X | WO 99 37775 A (GENQUEST INC) 29 July 1999 (1999-07-29) See the whole document, in connection with page 21 -page 28 | 35,36 |
| Y | Page 5 et sequentia | 1-34, 37-59 |
| Y | WO 97 25431 A (CORIXA CORP) 17 July 1997 (1997-07-17) the whole document | 1-59 |
| | -/-- | |

☒ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"Z" document member of the same patent family

Date of the actual completion of the international search

20 April 2001

Date of mailing of the international search report

09.07.01

Name and mailing address of the ISA

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Bretherick, J

INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 00/32520

| C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT | | |
|--|---|-----------------------|
| Category * | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
| Y | <p>DIATCHENKO L ET AL: "SUPPRESSION SUBSTRUCTIVE HYBRIDIZATION: A METHOD FOR GENERATING DIFFERENTIALLY REGULATED OR TISSUE-SPECIFIC CDNA PROBES AND LIBRARIES" PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF USA,US,NATIONAL ACADEMY OF SCIENCE. WASHINGTON, vol. 93, 1 June 1996 (1996-06-01), pages 6025-6030, XP002911922 ISSN: 0027-8424 Abstract, discussion, page 1520 et sequentia</p> <p>---</p> | 1-12, 57-59 |
| Y | <p>LEE S W ET AL: "POSITIVE SELECTION OF CANDIDATE TUMOR-SUPPRESSOR GENES BY SUBSTRUCTIVE HYBRIDIZATION" PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF USA,US,NATIONAL ACADEMY OF SCIENCE. WASHINGTON, vol. 88, 1 April 1991 (1991-04-01), pages 2825-2829, XP002048608 ISSN: 0027-8424 Abstract page 2826, column 2, paragraph 6 -page 2828, column 1, paragraph 1</p> <p>---</p> | 1-59 |
| Y | <p>BURGER A ET AL: "BREAST CANCER GENOME ANATOMY: CORRELATION OF MORPHOLOGICAL CHANGES IN BREAST CARCINOMAS WITH EXPRESSION OF THE NOVEL GENE PRODUCT DI12" ONCOGENE,GB,BASINGSTOKE, HANTS, vol. 16, 22 January 1998 (1998-01-22), pages 327-333, XP002914258 ISSN: 0950-9232 the whole document</p> <p>---</p> | 1-59 |
| Y | <p>SCHLOM J ET AL: "STRATEGIES FOR THE DEVELOPMENT OF RECOMBINANT VACCINES FOR THE IMMUNOTHERAPY OF BREAST CANCER" BREAST CANCER RESEARCH AND TREATMENT,US,NIJHOFF, BOSTON, vol. 38, no. 1, 1996, pages 27-39, XP000578043 ISSN: 0167-6806 the whole document</p> <p>---</p> | 1-59 |
| Y | <p>WO 99 14230 A (FLEMING TIMOTHY P ;WATSON MARK A (US); UNIV WASHINGTON (US)) 25 March 1999 (1999-03-25) the whole document</p> <p>-----</p> | 1-59 |

INTERNATIONAL SEARCH REPORT

national application No.
PCT/US 00/32520

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☒ Claims Nos.: -
because they relate to subject matter not required to be searched by this Authority, namely:
Although claims 20, 21, 28-30, 33, 34, 36-38 are directed to a method of treatment of the human/animal body, the search has been carried out and based on the alleged effects of the compound/composition.
2. ☒ Claims Nos.: -
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
see FURTHER INFORMATION sheet PCT/ISA/210
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:
1-59 (party)

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. Claims: 1-59 (partly)

Invention 1.

Isolated polypeptide comprising at least an immunogenic portion of a breast tumour protein, variants thereof such that the ability of variant to react with antigen-specific antisera is not substantially diminished, wherein the tumour protein comprises an amino acid sequence that is encoded by polynucleotide sequence SEQ. ID. NO: 2. or its complement; isolated encoding polynucleotide, expression vector, host cell transformed therewith; antibody specifically binding thereto; fusion proteins; pharmaceutical compositions and vaccines; therapeutic methods and methods of inhibiting growth/development of and removing tumour cells from a biological sample; methods of stimulating and/or expanding T cells specific; T cell populations prepared according to method; use thereof in therapy; diagnostic methods, Kits; oligonucleotides comprising 10-40 contiguous nucleotides that hybridise to SEQ ID NO: 2, kits containing same.

2. Claims: 1-59 (partly)

Inventions 2-284

As above, but respectfully referring to sequences 1,3-38, 42-204,205,207,210-290.

Note that sequences

1,6,8,9,11,12,14,17-20,22-24,26,27,29,31,32,34,36,37,38,42-62,64-71,74-80,82-102,105,106,110-117,119-127,130-133,135,137-158,162,163,165-180,182,205-207 are only mentioned in claims 24-52 per se.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

Continuation of Box I.2

Present claims 1(b),57..... relate to an oligonucleotide comprising 10 to 40 contiguous nucleotides that hybridise under moderately stringent conditions to a polynucleotide (SEQ ID NO:2)

The claims cover all oligonucleotides having this property, whereas the application provides support within the meaning of Article 6 PCT and/or disclosure within the meaning of Article 5 PCT for only a very limited number of same. In the present case, the claims so lack support, and the application so lacks disclosure, that a meaningful search over the whole of the claimed scope is impossible. Independent of the above reasoning, the claims also lack clarity (Article 6 PCT). An attempt is made to define the oligonucleotide by reference to a result to be achieved. Again, this lack of clarity in the present case is such as to render a meaningful search over the whole of the claimed scope impossible. Consequently, the search has been carried out for those parts of the claims which appear to be clear, supported and disclosed, namely those parts relating to the SEQ ID NO:2 per se.

Present claims 1,3..... relate to a variant encoded by SEQ ID NO 2 defined by reference to a desirable characteristic or property, namely "variants of said isolated polypeptide, the ability of the variant to react with antigen-specific antisera not being substantially diminished"

The claims cover all variants having this characteristic or property, whereas the application provides support within the meaning of Article 6 PCT and/or disclosure within the meaning of Article 5 PCT for only a very limited number of such products. In the present case, the claims so lack support, and the application so lacks disclosure, that a meaningful search over the whole of the claimed scope is impossible. Independent of the above reasoning, the claims also lack clarity (Article 6 PCT). An attempt is made to define the variants by reference to a result to be achieved. Again, this lack of clarity in the present case is such as to render a meaningful search over the whole of the claimed scope impossible. Consequently, the search has been carried out for those parts of the claims which appear to be clear, supported and disclosed, namely those parts relating to the SEQ ID NO: 2 per se, mentioned in the exemplification, sequence listing and claims. The claim set has been searched with this in mind.

The applicant's attention is drawn to the fact that claims, or parts of claims, relating to inventions in respect of which no international search report has been established need not be the subject of an international preliminary examination (Rule 66.1(e) PCT). The applicant is advised that the EPO policy when acting as an International Preliminary Examining Authority is normally not to carry out a preliminary examination on matter which has not been searched. This is the case irrespective of whether or not the claims are amended following receipt of the search report or during any Chapter II procedure.

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